

# AA AUTOMOTIVE INDUSTRIES

AUTOMOTIVE and AVIATION MANUFACTURING  
ENGINEERING • PRODUCTION • MANAGEMENT

**AUGUST 15, 1957**

## *In This Issue*

Unique Operations on TurgoGlide Transmission  
The A3D Skywarrior on the Production Line  
Advancements in the Investment Casting Process  
Design Changes Cost Less with Plastics Patterns  
Automatic Production Line for Ball Joints  
New Tractor Uses Air Pillows for Wheels

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A CHILTON PUBLICATION

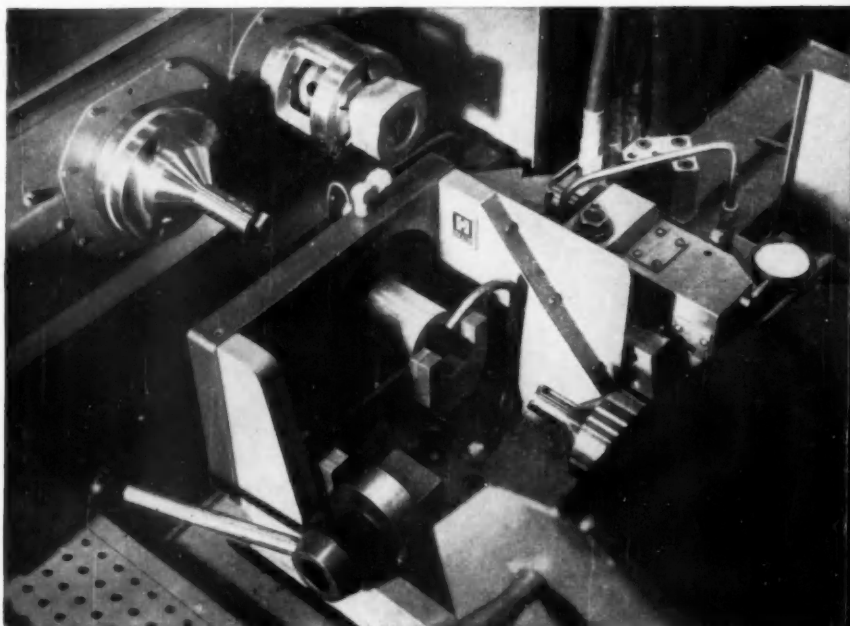
IN ANY MACHINE TOOL OPERATION,

# where do you look for the **PAY-OFF?**

- ☐ On the machine itself
- ☐ In subsequent assembly operations
- ☐ In the finished product

**On a Heald  
BORE-MATIC,  
pay-off time at  
the machine is  
only the beginning!**

*For example:* A manufacturer of portable tools purchased the Model 222 Bore-Matic shown here, for boring and facing various sizes of tool housings. Although results showed a worthwhile time saving of about 20%, this alone was hardly enough to justify the cost of the machine. But analysis of subsequent assembly operations some time later showed substantially reduced assembly times which *fully justified the investment*. Although average Boring time is only 1 or 2 minutes per piece, the assembly operations take from 30 minutes to 2½ hours and involve as many as five pieces that now fit exactly right because they've been through the Bore-Matic. However, the customer reports that the *major* advantage of the machine is improvement in quality of the finished product. Under previous methods, frequent trouble was encountered due to distortion of metal from improper clamping and locating. So this Heald Bore-Matic not only saved machine time and cut production costs, but also contributed to a *better and more saleable* product.



**T**HE *precision production* that you get from a Heald Bore-Matic or Internal Grinder is not an end in itself. Actually, it's the start of a chain reaction that will be felt in subsequent assembly operations and even in the performance and saleability of the finished product as well.

When you measure the length of time it will take for a machine to pay for itself, it's important to look at the *overall* picture. Take the savings you get at the machine. Add the savings from reduced assembly time. And if you can put a dollar value on the resulting improvement in product quality, add this too. You'll find that . . .

***IT PAYS TO COME TO HEALD***



**THE HEALD MACHINE COMPANY**

Subsidiary of The Cincinnati Milling Machine Co.

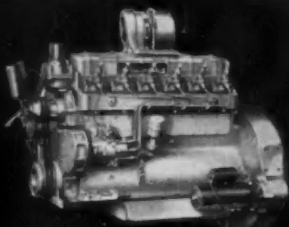
Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

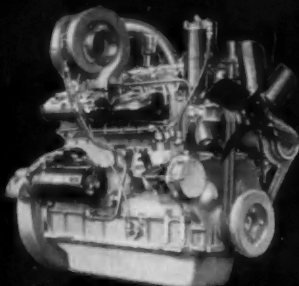


# THE PAYLOAD POWER PLANT

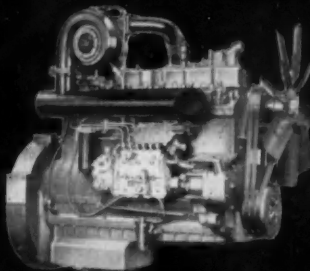
- fast
- smooth
- powerful



197-DLCS—Turbocharged Diesel



135-DKBS—Turbocharged Diesel  
(Also normally aspirated)



148-DKBS—Turbocharged Diesel  
(Also normally aspirated)

Write for descriptive bulletins  
**WAUKESHA MOTOR COMPANY**  
Waukesha, Wisconsin  
New York • Tulsa • Los Angeles

TURBO-SUPERCHARGED DIESELS							
MODEL	Cyl.	*Features	Bore and Stroke	Displ. Cu. In.	Max. Torque @ RPM	Max. HP	RPM
197-DLCS	6	AT	4 x 4	302	280-2000	131	2800
135-DKBS	6	ACTV	4 1/4 x 5	426	400-1800	185	2800
148-DKBS	6	ACTV	5 1/4 x 6	779	706-1800	280	2100
WAKDBS	6	ACTV	6 1/4 x 6 1/2	1197	1062-1600	352	1800
NORMAL DIESELS							
180-DLC	4	AC	3 1/2 x 3 3/4	144	102-1800	45	2400
185-DLC	6	A	3 1/2 x 3 3/4	216	152-1200	60	2400
190-DLCA	6	AC	3 3/4 x 4	265	191-1400	85	2800
195-DLCA	6	AC	4 x 4	302	221-1800	98	2800
135-DKB	6	ACV	4 1/4 x 5	426	328-1600	147	2800
148-DKB	6	ACV	5 1/4 x 6	779	584-1000	200	2100
WAKDB	6	ACV	6 1/4 x 6 1/2	1197	845-1000	258	1800
GASOLINE							
180-GLB	4	AC	3 1/2 x 3 3/4	144	118-1600	45	2400
185-GLB	6	A	3 1/2 x 3 3/4	216	176-1400	67	2400
190-GLB	6	A	3 3/4 x 4	265	220-1200	77	2400
195-GKA	6	ACV	4 1/8 x 4	320	243-1600	122	3000†
MZA	6	A	4 1/4 x 4 3/4	404	289-1000	128	2800†
135-GKB	6	ACV	4 1/4 x 5	426	337-1200	147	2800†
135-GZB	6	ACV	4 3/8 x 5	451	354-1200	153	2800†
140-GKB	6	ACV	4 1/2 x 5 1/2	525	425-1000	177	2600†
140-GZB	6	ACV	4 3/8 x 5 1/2	554	448-1100	188	2600†
145-GKB	6	ACV	5 1/4 x 6	779	595-1000	240	2400†
145-GZB	6	ACV	5 3/8 x 6	817	630-1100	250	2400†
WAKB	6	ACV	6 1/4 x 6 1/2	1197	1000-1000	280	1800

\*FEATURES: A—Aluminum Alloy Pistons; C—Counterbalanced Crankshaft; T—Turbo-Supercharged; V—Vibration Dampener.

†These engines rated at higher hp and rpm for fire engine service. Send for Bulletin 1079 for LPG ratings and complete listing of engine hp and speed ratings.

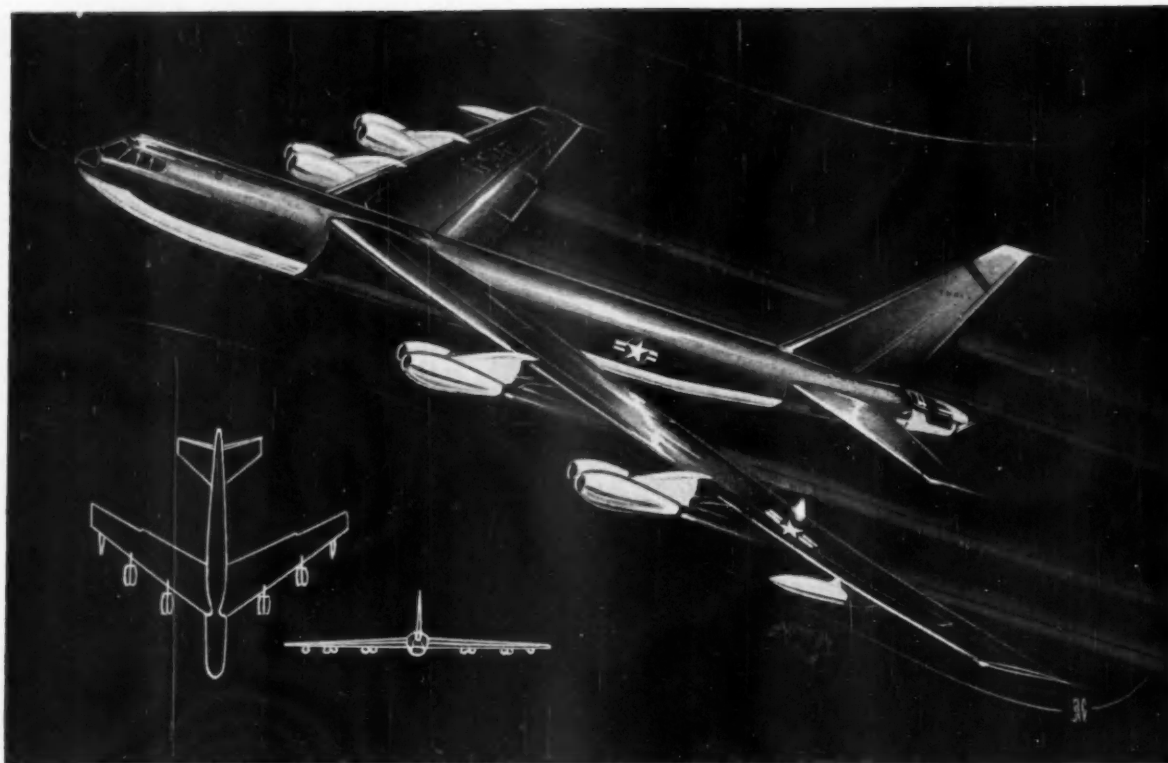
## WAUKESHA ENGINES

**NORMAL and TURBOCHARGED DIESELS**  
... GASOLINE ... LP GAS  
Standard or Counterbalanced Crankshafts



Truck powered by Waukesha  
148-DKB Normal Diesel

345-R



**B-52 Stratofortress** — This global bomber is powered by eight J-57 turbo-jet engines, paired in sharply-raked forward pods. Her service ceiling is above 50,000 feet.

## Designer stuffs a gasket so B-52 can flex its wings

The Inco Nickel Alloy that gives gaskets for hot gas ducts in the B-52 their "give" may prove useful to you.

Imagine a gasket that stays lively during repeated flexing at temperatures up to 600°F.

What material would you use?

Designers of the B-52 did it with Inconel® nickel-chromium-iron alloy knitted mesh stuffed into a hollow ring.

It's the "give" in this wire mesh and tube retainer that helps the gas-

ket maintain its perfect seal.

### What gives the retainer its "give" at high temperatures?

Inconel alloy's outstanding resistance to relaxation in the 500° to 700°F. range which is why Inconel alloy is used for high temperature springs. This Inco Nickel Alloy also provides a combination of other useful properties: good strength, ductility and resistance to oxidation at high temperatures.

### Where should you use special alloys?

Have a chat with Inco's Mechanical Engineering Section. Their wide experience in the application and performance of Inco Nickel Alloys may prove helpful in finding alloys to meet metal problems in many different areas. As a starter — outline your problem and send it to:

**The International Nickel Company, Inc.**  
67 Wall Street New York 5, N. Y.



## Inco Nickel Alloys

are marketed under the following trademarks:  
MONEL • "R" MONEL • "K" MONEL • "KR" MONEL  
"S" MONEL • INCONEL • INCONEL "X" • INCONEL  
"W" • INCONEL "700" • INCOLOY • INCOLOY "T"  
INCOLOY "901" • NIMONIC Alloys

### Where Inco Nickel Alloys are used in jet aircraft

#### Inconel

Combustion liners  
Transition sections  
Insulating blankets  
Lock wire and rivets  
Fuel line tubing

#### Incoloy "T"

Transition sections  
Combustion liners  
**Incoloy "901"**  
Turbine discs

#### Inconel "X"

Rotor discs  
Afterburner bellows  
High-temperature bolts  
Rocket engine rotors

#### Monel

Lock wire  
Fine fuel line  
tubing  
Rivets

#### Nimonic Alloys

Combustion liners  
Transition sections  
Vaporizer tubes  
Turbine blades  
Rotor discs

#### "S" Monel

Ball bearing retainer  
rings

#### Inconel "W"

Tail cones  
Afterburners  
**Inconel "700"**  
Turbine blades

Pure Nickel for electrical  
and electronic gear. Pri-  
mary Nickel as alloying  
element in other materials. Inco  
Precision Castings in many different alloys.

# AUTOMOTIVE INDUSTRIES

A CHILTON MAGAZINE PUBLISHED SEMI-MONTHLY

AUGUST 15, 1957

VOL. 117, NO. 4

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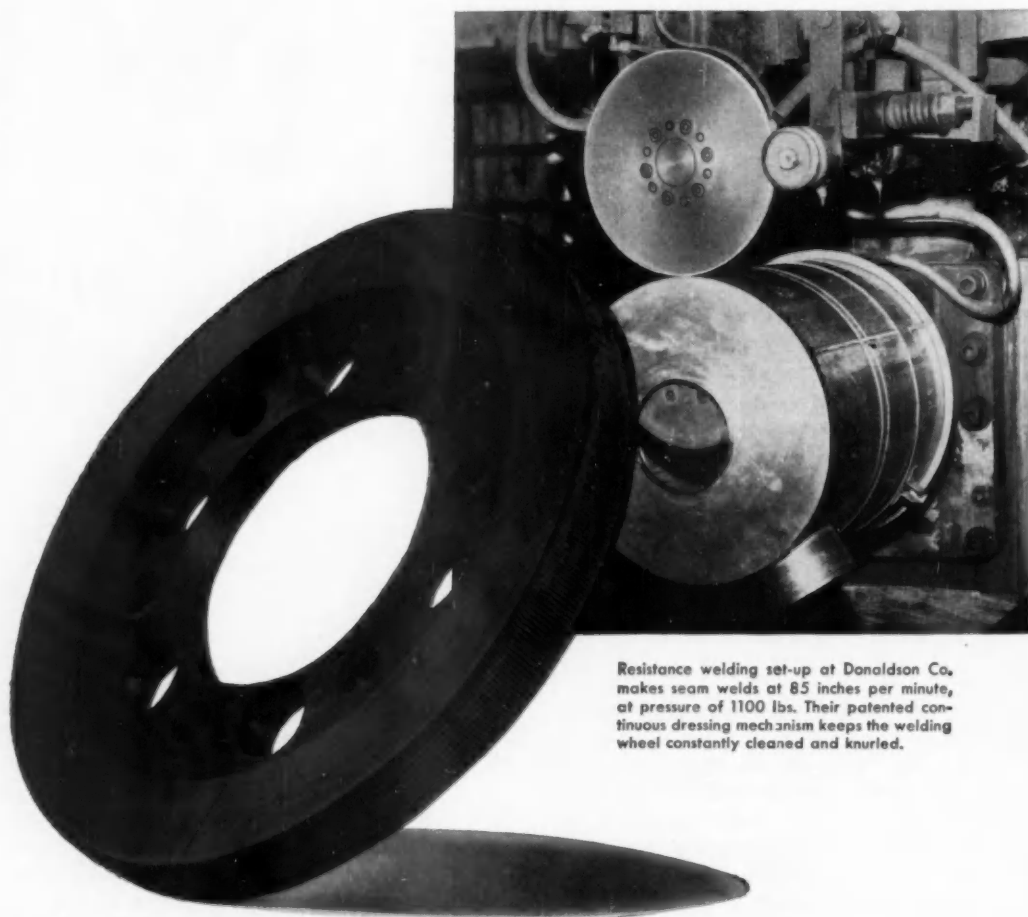
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Resistance welding set-up at Donaldson Co. makes seam welds at 85 inches per minute, at pressure of 1100 lbs. Their patented continuous dressing mechanism keeps the welding wheel constantly cleaned and knurled.

## Half a Million Feet of Seam ... Welded by This Mallory Wheel

How long do Mallory seam welding wheels last? Here's an example.

At the Donaldson Company, St. Paul, Minnesota, the Mallory 22 seam welding wheel shown above has just been retired after making about 500,000 feet of  $\frac{1}{8}$ " lap mesh weld on the body sections of big internal combustion engine air cleaners. This service, according to Donaldson, is 3.2 times the life that they used to get with ordinary seam welding wheels.

Several reasons are behind the long life of Mallory wheels. Specialized alloys go into them, developed by

Mallory during more than 30 years of leadership in resistance welding. Equally important is the extreme hardness and wearing ability that Mallory adds to these alloys. The result—more welds, better welds, per dollar.

For a cost-cutting consultation on your own resistance welding applications, see your local Mallory Welding Distributor. He carries a complete stock of Mallory electrodes, holders, seam welding wheels and bar stock. And he's well qualified to help you apply these precision-made products profitably.

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For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio

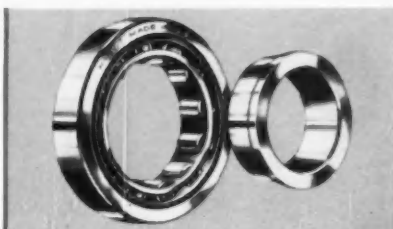
There's a  
**HYATT HY-ROLL**  
 for  
 every  
 speed—



**LOW**

**Industrial Inch Series**  
 For speeds up to 600 rpm

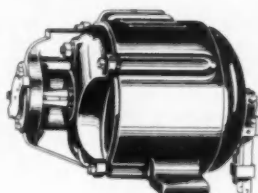
Specifically designed for slow-moving, heavily loaded machinery where large diameter shafts are the rule. Available in fractional size bores for shafts from 4 inch diameter upwards.



**MEDIUM**

**Hy-Load Series**  
 For speeds up to 5,000 rpm

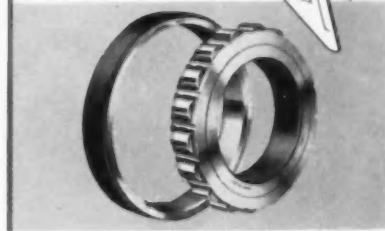
High-capacity cylindrical roller bearings for heavy radial loads and light or intermittent thrust loads. Available in a complete range of sizes and types.



**HIGH**

**Aircraft Series**  
 For speeds up to 50,000 rpm

Ultra-high-speed cylindrical roller bearings for jet engines and similar applications where rpm's are extremely high. Available in over 100 sizes and types.



If you would like the technical assistance of an experienced sales engineer, phone or write Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey; Pittsburgh; Chicago; Detroit; Oakland, California.

**HYATT** **HY-ROLL BEARINGS**  
 FOR MODERN INDUSTRY

FOR REPLACEMENT BEARINGS, SEE YOUR HYATT INDUSTRIAL BEARINGS DISTRIBUTOR





**THIS LABORATORY TEST** of cords taken from test-fleet tires proves that ordinary tire cord loses strength from flexing twice as fast as nylon tire cord . . . proves that nylon cord gives lasting strength for safety and endurance.

**IN THE FINAL TEST**, the lasting strength of nylon tire cord has been proved in billions of miles of heavy-duty service on trucks. Nylon cord tires are standard equipment on commercial airlines, too.



## TEST AFTER TEST PROVES NYLON TIRE CORD GIVES EXTRA STRENGTH FOR EXTRA SAFETY



**These influential magazines** will carry Du Pont nylon cord tire advertising throughout the year. These ads tell your customers of nylon's lasting ability to shrug off the continual abuse of day-after-day driving and thus offer utmost safety on the highway.

The lasting strength and safety of nylon tire cord have been proved both in the laboratory and on the highway. Nylon cord withstands the added strains of today's more powerful cars and the sustained speed permitted on superhighways. Nylon cord protects against the four major causes of blow-out: heat, moisture, flex fatigue and bruise damage . . . gives motorists added safety and dependability they want in a tire.

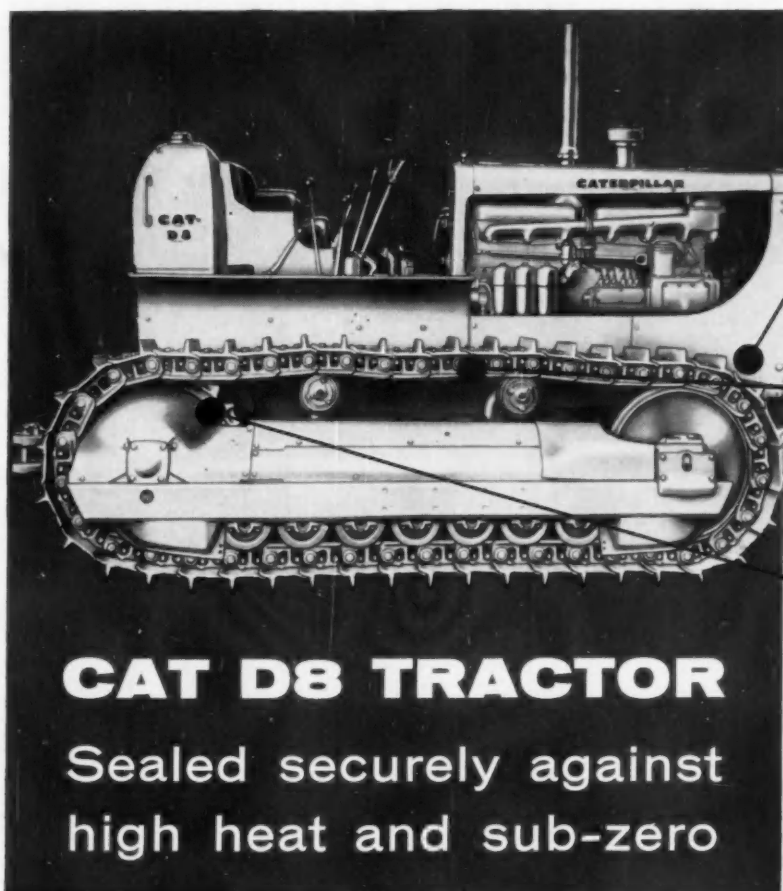
Nylon cord tires can reduce unsprung weight, and nylon's shock-absorbing toughness can take the additional strains of power steering, power braking and higher horsepower. Surveys and rising sales both show that today's motorists know and want the extra strength and safety of nylon cord tires, the tires made to meet modern driving needs.

**40% of all passenger-car replacement tires sold are nylon.**



BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

**Today, the strongest, safest tires are made with nylon cord**



## CAT D8 TRACTOR

Sealed securely against  
high heat and sub-zero



Front Crankshaft Seal—Type K-6 dual lip design with high heat- and oil-resisting Victoprene sealing element. Metal O. D. assures perfect press fit.



Rear Crankshaft Split Seal—Two-section Victoprene seal eliminates need of dropping shaft when removing and replacing. Semicircular molded construction integral with frame. Victoprene coating on O.D.



Beveled Gear Shaft and Pinion Seals—Type K-6 dual sealing lip design provides maximum retention of lubricant and exclusion of foreign matter. Spring maintains uniform sealing pressure. Chemically bonded to metal-encased construction.

## with Victoprene silicone and polyacrylic compounds

Oil seals, shown above, on the Caterpillar D8 tractor make a clean break with former standards for extreme operating conditions and oil-resistance characteristics. They're specified for the toughest working conditions facing construction and road building machinery.

As fast as your new sealing requirements develop, count on Victor for complete help in meeting each specification. The answer may be in the variety of Victor-developed synthetic compounds and designs with excellent resistance to low and high temperatures,

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# VICTOR

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**OIL SEALS • GASKETS • PACKINGS • MECHANICAL SEALS**

# Leakproof Bundyweld Tubing feeds



This double exposure shows how a driver can raise or lower the Citroën body at will, when traveling rutted roads or when changing tires. In normal operation, height-corrector valves automatically maintain proper road clearance, regardless of load. The system provides independent suspension for each wheel; depends on leakproof Bundyweld Tubing to carry its hydraulic fluid without failure.

## BUNDYWELD IS DOUBLE-WALLED FROM A SINGLE STRIP



Bundyweld starts as a single strip of copper-coated steel. Then it's . . .



continuously rolled twice around laterally into a tube of uniform thickness, and



passed through a furnace. Copper coating fuses with steel. Result . . .



Bundyweld, double-walled and brazed through 360° of wall contact.



SIZES UP  
TO ¾" O.D.

NOTE the exclusive Bundy-developed beveled edges, which afford a smoother joint, absence of bead, and less chance for any leakage.

# Citroën's hydro-pneumatic suspension\*

Transmission, clutch, brakes, and steering also served by centralized hydraulic system through reliable Bundyweld

Fabulous is the word for Citroën's unique hydro-pneumatic suspension. It utilizes a combination of oil and inert gas under pressure to soak up every last jolt and jar for a cloud-soft ride. But Citroën's suspension and other power-assisted components need an unending supply of hydraulic fluid. And this is delivered unfailingly through Bundyweld Tubing®.

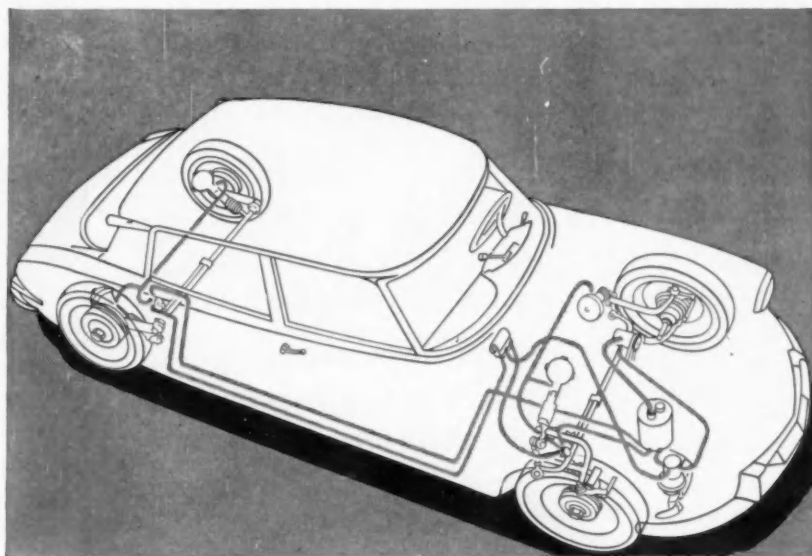
Ultrareliable is the word for Bundyweld Tubing. Because it is the only tubing double-walled from a single steel strip, then metallurgically bonded through 360° of wall contact, Bundyweld is amazingly strong and resistant to vibration fatigue... leakproof by test.

This same exclusive process gives Bundyweld high

bursting strength and tensile strength... makes it smooth, ductile and easy to fabricate, even in the most complex shapes. These properties are the reasons Bundyweld is used on 95% of today's cars, in an average of 20 applications each!

Whether you want tubing straight, coiled, or fabricated precisely to specification, Bundy® will handle the job. Your tubing will be packaged carefully, delivered right on schedule—clean, bright and ready to use. And Bundy offers free, expert engineering service as well. Need tubing for mechanical or fluid transmission applications on cars, trucks, or farm equipment? Chances are you'll save time and money by checking first with Bundy. Call, write, or wire us today!

BUNDY TUBING COMPANY • DETROIT 14, MICHIGAN



Heart of Citroën's centralized hydraulic system is a high-pressure, 7-piston pump which drives hydraulic fluid into a constant-pressure accumulator. From there, it feeds through dependable Bundyweld Tubing to the suspension, shown in schematic diagram at left. Other power-assisted components: *Clutch*—standard-type automatically disengages when gearshift is moved, or engine rpm's fall to idling. *Transmission*—manual shift actuates hydraulic-assisted selector forks. *Brakes*—two separate Bundyweld lines supply front disc brakes and rear drum brakes. *Steering*—hydraulic cylinder moves standard rack and pinion either way on demand.

\*Citromatic®

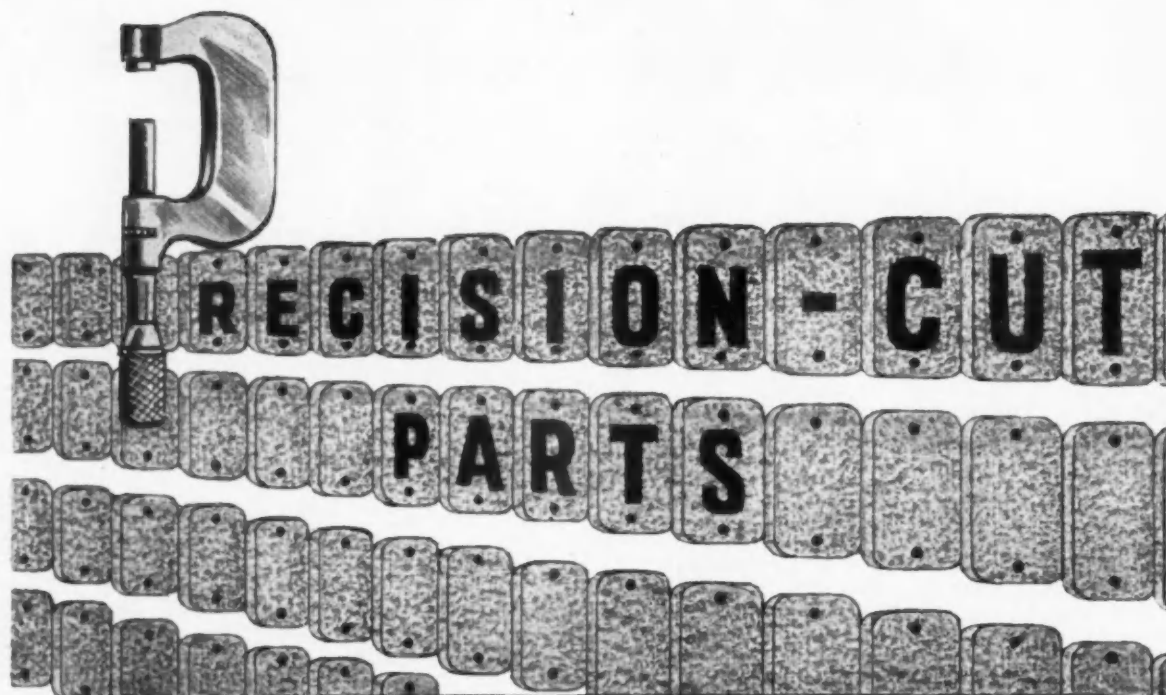
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Bundy Tubing Distributors and Representatives: **Massachusetts:** Austin-Hastings Co., Inc., 226 Binney Street, Cambridge 42 • **Pennsylvania:** Ruten & Co., 1 Bala Ave., Bala-Cynwyd • **Midwest:** Lapham-Hickey Steel Corp., 3333 W. 47th Place, Chicago 32, Ill. • **South:** Feinson-Deakins Co., 823-824 Chattanooga Bank Bldg., Chattanooga 2, Tenn. • **Southwest:** Vinson Steel & Aluminum Co., 4606 Singleton Blvd., Dallas, Texas • **Northwest:** Eagle Metals Co., 4755 First Avenue, South, Seattle 4, Wash. • **Far West:** Pacific Metals Co., Ltd., 2187 S. Garfield, Los Angeles 22, Calif. • **Pacific Metals Co., Ltd.,** 1900 Third Street, San Francisco 7, Calif.

Bundyweld nickel and Monel tubing are sold by distributors of nickel and nickel alloys in principal cities.

WORLD'S LARGEST PRODUCER OF SMALL-DIAMETER TUBING • AFFILIATED PLANTS IN AUSTRALIA, ENGLAND, FRANCE, GERMANY, AND ITALY





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Tell us your basic problem—and we'll put 55 years experience to work in recommending a solution for you. Our engineers find new uses for felt every day. Your inquiry will receive prompt attention.

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Chicago 23, Illinois

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**WORKS**

MANUFACTURERS AND CUTTERS OF WOOL FELTS



# Does A Big Job

# Takes Less Space

## TYPE Z RELAY

### by Westinghouse

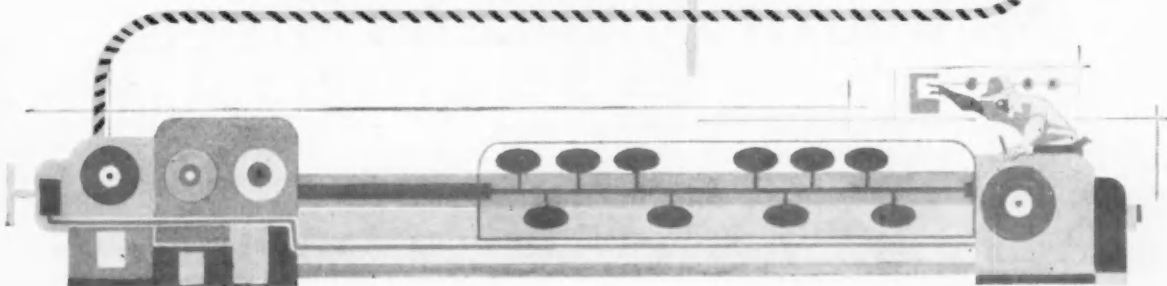
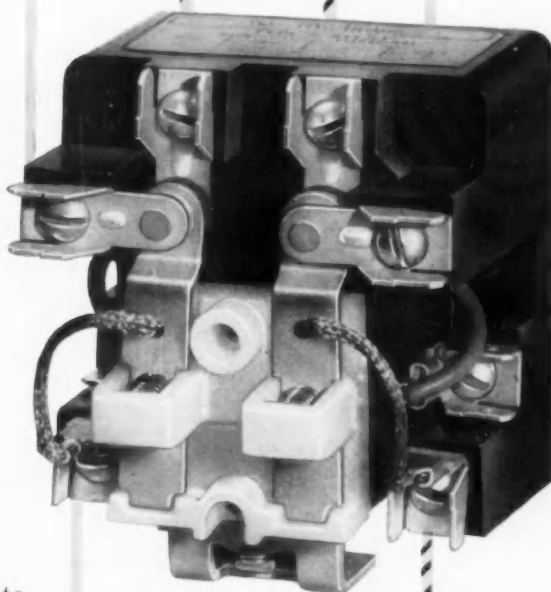
Small, versatile, amazingly rugged, this new Westinghouse 10-amp relay is designed for long life and high reliability. The relay user who has space problems . . . wants a lot of relay in minimum mounting space finds Type Z ideally suited. Type Z meets U. L. Standards for 300 volts, is equipped with double-pole double-throw contacts of fine silver. Coil and core are interchangeable for a-c or d-c operation. An ideal relay for auxiliary multiple-circuit switching of light loads, small motors or for operating larger contactors or starters.

J-30262-A

**YOU CAN BE SURE...IF IT'S**  
**Westinghouse**



Nylon armature insulating plate  
Encapsulated removable coils  
Firm contact pressure, low resistance





## **bright idea**

For enduring beauty that sells in a new car and  
re-sells in a used car . . . design it, improve it and protect it  
with McLOUTH STAINLESS STEEL.

**specify**

# **McLOUTH STAINLESS STEEL**

HIGH QUALITY SHEET AND STRIP

**for automobiles**



**McLOUTH STEEL CORPORATION** DETROIT, MICHIGAN  
MANUFACTURERS OF STAINLESS AND CARBON STEELS

another result of A-MP'S CREATIVE APPROACH . . .

## *Fastin-Faston\* Harness Connectors*

*for simultaneous engagement*

*of multiple circuits*

*in appliance and automotive wiring*

A new highly versatile assembly unit that makes one operation out of many. Saves time, trouble, money.

Simplifies such operations as the connecting of wall switches to built-in ranges . . . top with bottom circuits in clothes washer . . . front and back assemblies to car electrical systems.

Uses quick, easy-to-apply Faston terminals. Can be used for as many as six individual circuits.

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additional information.**



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**Japanese Distributor:**

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\*TRADEMARK

# NEW GOLDEN BONDERITE for Aluminum

**Uniform color means uniform coatings  
and uniform efficiency**

It's the simplest thing in the world to check on the efficiency of a Golden Bonderite installation. Just look at the color of the aluminum as it comes out of the Bonderite machine. The uniform golden coating looks the same—and it is the same—24 hours a day, seven days a week.

Golden Bonderite sets entirely new standards of efficiency and performance as a paint base for aluminum and its alloys. Operated with the Parker "Reactifier," the Golden Bonderite solution can be used indefinitely, ending the costly necessity of dumping the bath at frequent intervals. Normal chemical replenishment keeps the Golden Bonderite solution in continuous balance.

This ease and certainty of achieving uniformly excellent results means real savings for aluminum fabricators.

It guarantees an effective base for paint.

It breaks the finishing line production bottleneck.

It saves money on chemicals.

It saves money on rejected parts and minimizes field calls because of finish failures.

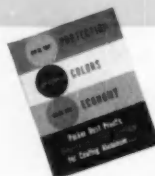
There are no limitations on the use of new Golden Bonderite. It may be applied by spray or immersion. Treatment cycles can be set to suit production speed and equipment.

Samples of Golden Bonderite-treated aluminum, plus test data, are available for your inspection. Write or call.

## How Parker "Reactifier" Works

In conventional surface treatments of aluminum, work passing through the solution causes a buildup of impurities. As impurities increase, solution efficiency decreases until there's nothing to do but dump the bath and start over.

The Parker "Reactifier" removes these impurities as fast as they are formed in the Golden Bonderite solution. Constant circulation of the Golden Bonderite through the exclusive "Reactifier" means a balanced, efficient solution that can be used indefinitely.



**Write for Bulletin in COLOR!**

Get your copy of the descriptive bulletin on Golden Bonderite and its companion, Green Bonderite, for aluminum. It's new!



**PARKER RUST PROOF COMPANY**  
2178 E. MILWAUKEE, DETROIT 11, MICHIGAN

**BONDERITE**  
corrosion resistant  
paint base

**BONDERITE and BONDERLUBE**  
aids in cold forming  
of metals

**PARCO COMPOUND**  
rust resistant

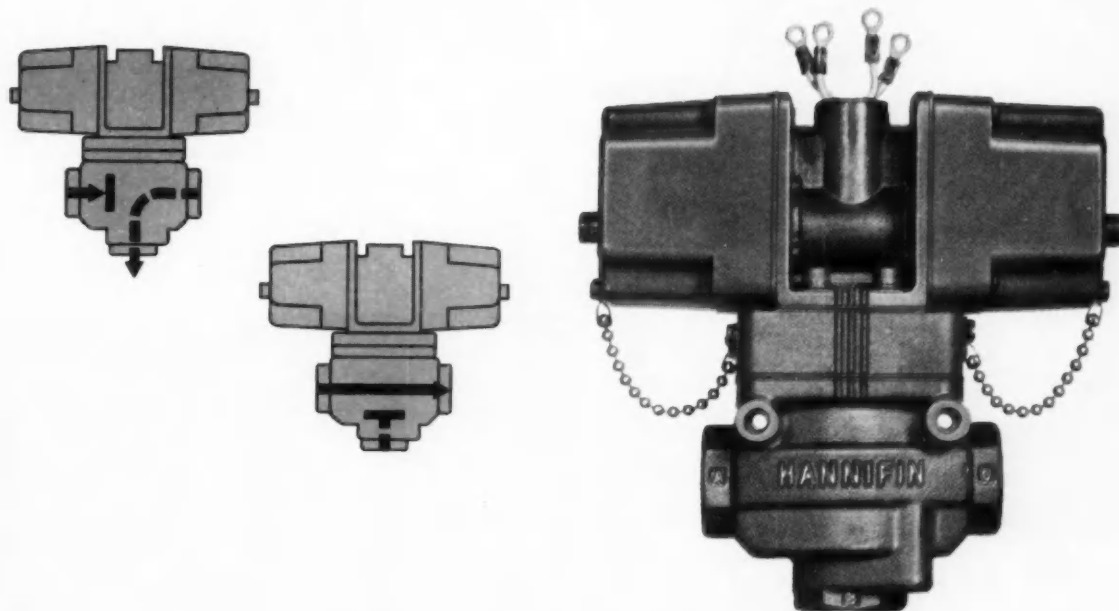
**PARCO LUBRITE**  
wear resistant for friction  
surfaces

**TROPICAL**  
heavy duty maintenance  
paints since 1883

\*Bonderite, Bonderlube, Parco, Parco Lubrite, —Reg. U.S. Pat. Off.

# Setting the pace for automation

## ...Hannifin valves



**Automatic processes** call for speed, sensitivity and flexibility in directional air control. Above all, they demand dependability. That is why so many valve users find it pays to choose Hannifin.

Every feature that contributes to dependable performance has been incorporated in Hannifin air control valves. This dependability is the result of never-ending research and development.

In the broad Hannifin line, you will find valves with new exclusive features...valves for practically any kind of automatic sequential operation. All are simple in design, with few and easily replaceable parts.

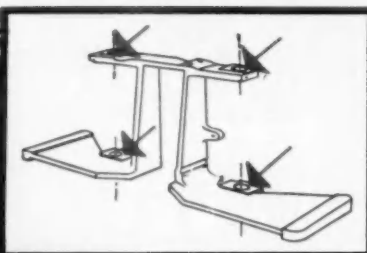
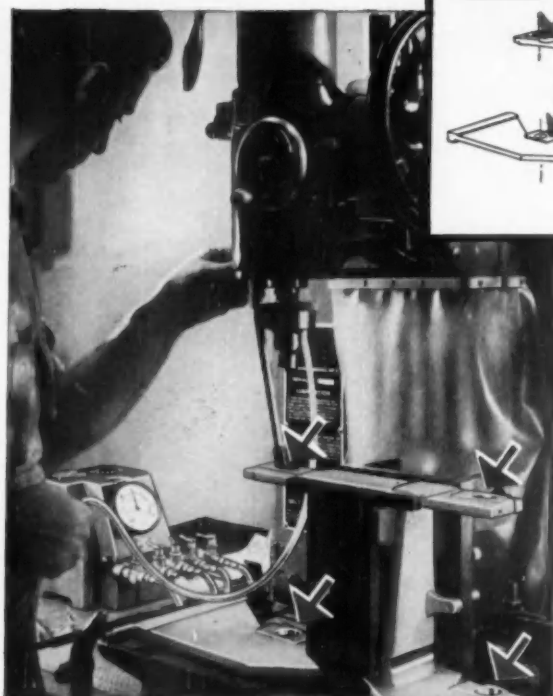
### AIR CONTROL **HANNIFIN** VALVES

For this complete catalog showing all the Hannifin directional air control valves, write to Hannifin Corporation, 543 South Wolf Road, Des Plaines, Illinois.



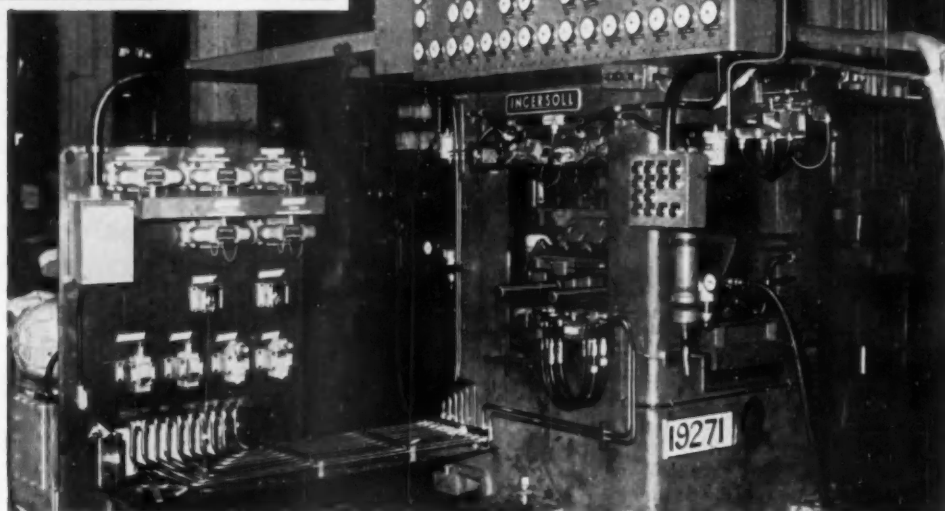


# THEY GAGE THESE



This application at the Arrow Tool Company, Inc., illustrates the adaptability of the Dimensionair. Here it is equipped with a 5-way manifold to which different gaging units are attached ready for other jobs. On this job a Model A-1250 Adjustable Bore Gage is used to inspect 4 holes. Note

that with this particular gage the handle does not have to line up with the hole. Many other jobs, having tolerances from .0004" to 50 millionths, are inspected by this Dimensionair.



Federal air-electric gaging and classifying equipment was used in this gaging station on an engine block transfer line. Two diameters in each of five crankshaft bores and two each in five camshaft bores are measured — twenty holes in all. After automatic assembly, oil holes in the five bearing liners are checked for alignment with the holes in the camshaft

bores. All conditions are checked simultaneously. Signal lights indicate all dimensional conditions. Unsatisfactory blocks are automatically rejected. Cycle time is well within production cycle time. Ingersoll Milling Machine Company supplied the handling and positioning units.

# **JOBS BETTER**

## **with the** ***DIMENSIONAIR***

The increased complexity of more and more of today's gaging requirements calls for the utmost in dependable accuracy. So many times the accuracy of one dimension is dependent upon the accuracy of another. Automation, too, brings in another set of complications where misbehavior of the gaging process can upset your whole schedule.

The dependable no-drift accuracy of the Dimensionair is of the utmost advantage in such cases. Its reliability keeps quality up and keeps production rolling. Even on the simpler jobs the dependable no-drift accuracy and the foolproof operation of the Dimensionair are definitely appreciated. Call on us if you want to do a better gaging job. See our address below.

Two differential type Dimensionairs are used on this precision assembly. The first step is shown at right. Parallel bores in a gear-type fuel pump housing are located on the twin gaging plugs and the bushings that are to be pressed into these bores are placed in the twin ring gage at the right. The Dimensionair shows whether the flange flats on the bushings will have the proper clearance when bushings are assembled in the housing.



A second gage is used for the next step. After the bushings are inserted in the housing, they are located on the left hand pair of gage plugs. Then, a different set of bushings for the cover plate is placed on the right hand plugs. The single dial on this gage shows whether the center distances in the two pairs of bushings are the same within a tolerance of  $\pm .0005''$ . If the first two cover plate bushings measured do not meet this standard, others can be tried until a pair is found that does. Proper alignment of these bearing surfaces is assured at final assembly.

**FEDERAL PRODUCTS CORPORATION • 7268 EDDY STREET, PROVIDENCE 1, R. I.**

*Ask* **FEDERAL** *First*

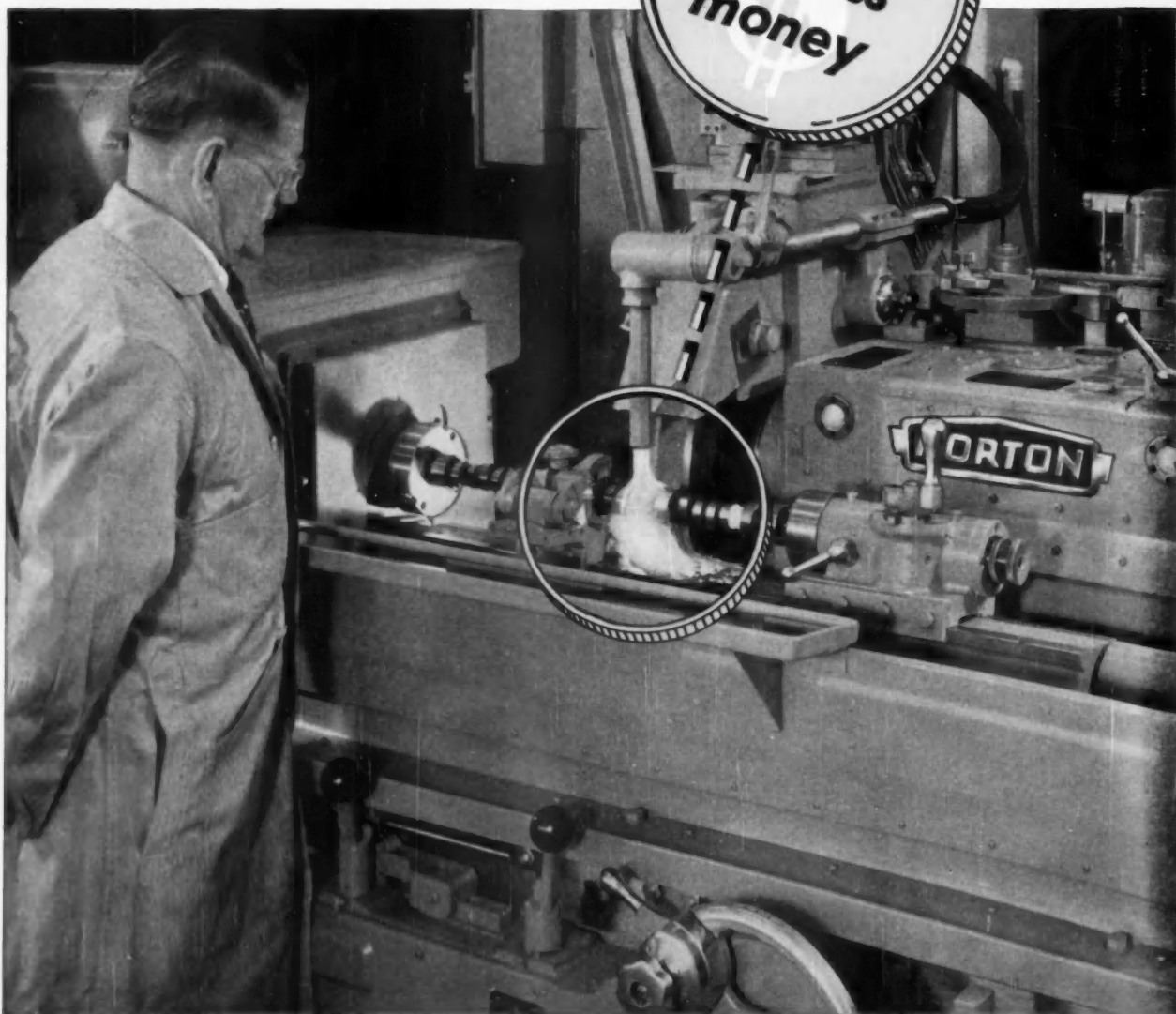
**FOR RECOMMENDATIONS IN MODERN GAGES . . .**

**Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging**

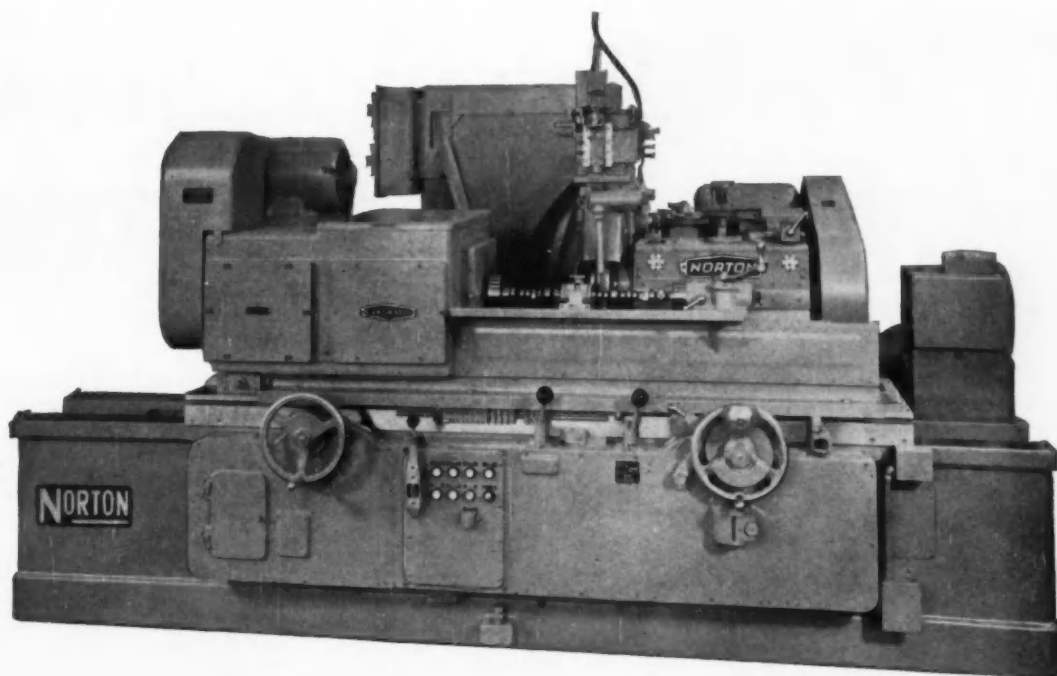
## Norton's Newest!

# The No. 3 CAM-O-MATIC grinds camshafts better...

and  
for less  
money



**BUILT-IN OPERATING SKILL** of the No. 3 CAM-O-MATIC Grinder is a typical Norton "Touch of Gold" that adds value and boosts profits. Many automatic features on this greatly improved machine reduce the operator's duties to loading and unloading. He can easily tend two or more machines — while you get better grinding for less money.



## Highly advanced automatic grinder sets new standards for production, precision and finish

With the No. 3 CAM-O-MATIC Grinder, Norton introduces a new concept of efficiency in camshaft grinding.

No other machine of its type offers you such a combination of exclusive features, rugged construction and simplified operation. No other machine can do more towards stepping up the quality of your camshaft production, while cutting grinding time and costs.

### Greater Rigidity Improves Performance

The No. 3 CAM-O-MATIC Grinder features solid, rigid construction that means minimum vibration, more accurate performance and longer service life. Another big advantage for fluid, shockless operation is that the entire operating cycle is geared to split-second efficiency. Indexing is ultra-smooth and extra-rapid. And the wheel-slide retraction after grinding each cam is no greater than maximum stock removal.

### Speed is always right — automatically

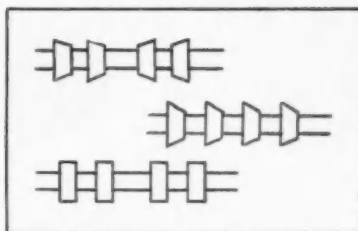
The No. 3 CAM-O-MATIC Grinder's automatically compensating work speed arrangement is a valuable aid

to faster, more accurate grinding. Starting with the ideal speed for rapid stock removal, it changes to exactly the right speed for fine finishing and contour accuracy — as each cam is being ground. This eliminates guesswork, manual adjustment and lost motion.

### Wheel truing is automatic, too

Still another example of built-in operating skill is the wheel truing device, in which the truing diamond is automatically advanced across the wheel face and back, cutting in both directions. This is done while the operator is loading and unloading, so no time is lost. And by removing only just the amount of abrasive required for truing, the working life of every wheel is prolonged.

### Your choice of tapers



The swiveling wheel slide — a Norton patent — permits grinding cam tapers in one direction (standard equipment) or tapers in opposite directions on the same shaft (an optional extra). Both arrangements permit straight-face grinding, as well — thus increasing the versatility of your camshaft production equipment.

See your Norton Representative — or write direct — for full details on the No. 3 CAM-O-MATIC Grinder. And remember, only Norton offers you such long experience in both grinding machines and wheels to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

To Economize, Modernize with NEW

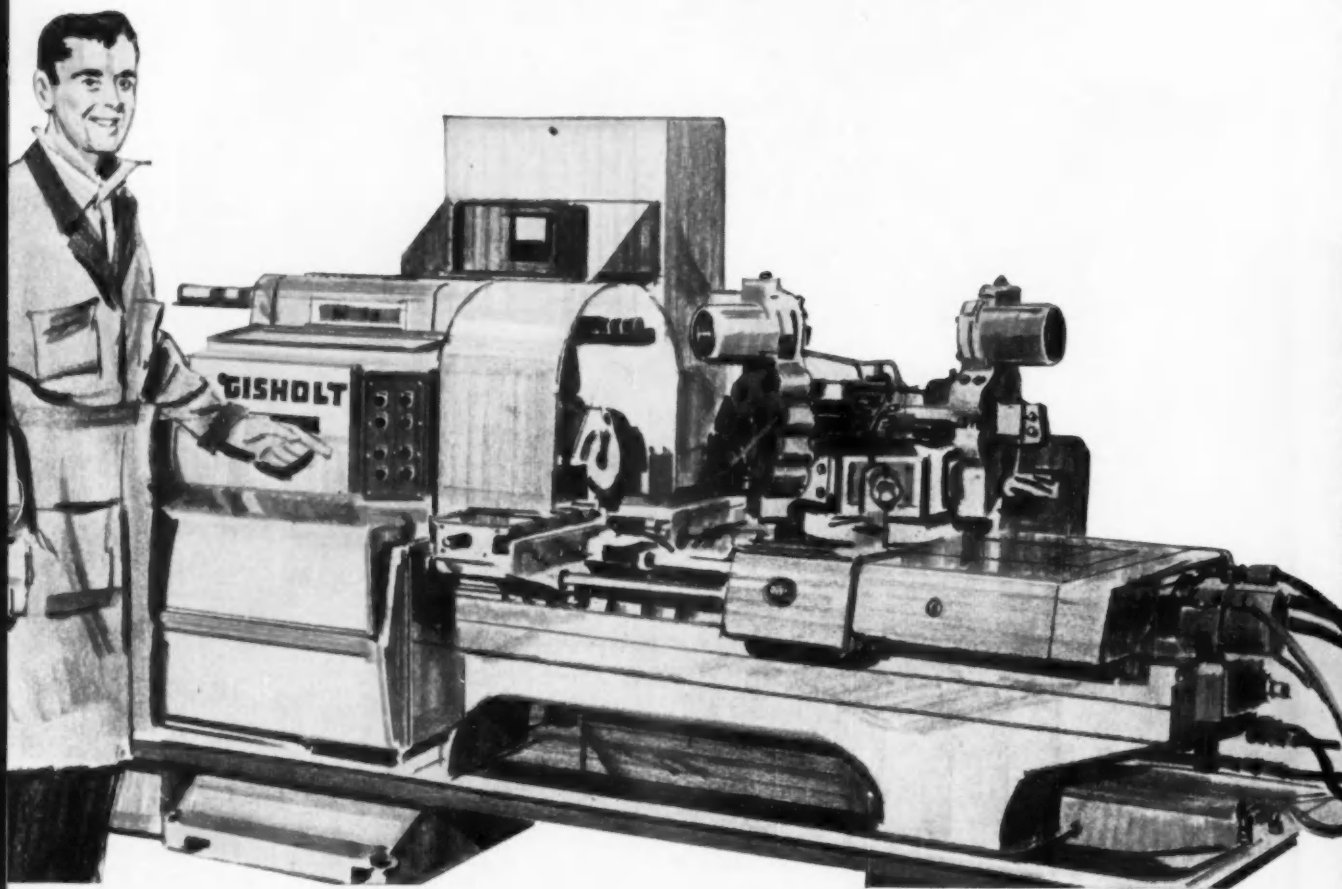


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*Making better products...  
to make your products better*

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# *NEW Gisholt Fastermatic* **CUTS YOUR SETUP TIME**



**GISHOLT**  
MACHINE COMPANY  
Madison 10, Wisconsin



TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS



# control panel

# 50% OR MORE

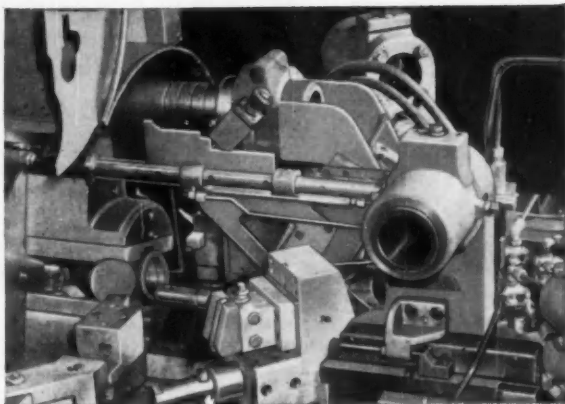
BY SIMPLY FLIPPING TOGGLE SWITCHES, your operators can cut automatic turret lathe setup time 50% or more with this electric setup control panel.

Thoroughly proved in production lines, this control panel is one of the many advanced features available on the new Gisholt MASTERLINE Fastermatic Automatic Turret Lathe.

Here's how the panel works: within finger-tip reach, your operator has a horizontal row of toggle switches for each face of the hexagon turret. By simply flipping the switches right or left, he pre-selects desired machine functions. Re-runs? Here the Fastermatic makes even more drastic cuts in setup time. A master reference card, made from the previous run, is used, and the machine is ready to go with absolute minimum preparation. Feed changes are fast and easy. Tool overhang is quickly minimized by re-positioning the saddle. Anywhere within the machine cycle, the operator can make a trial cut, withdraw the tools, make the part, re-set the tools and resume forward feed.

What does this versatility mean to your own operations? It means more time spent cutting chips and more profit per piece. It means that less skill is required of the operator and he is free to handle additional units or do other work during machining cycles. It means you can utilize smart tooling and eliminate human errors...get record production on long runs...and also get the advantages of automatic cycle operation on relatively short runs.

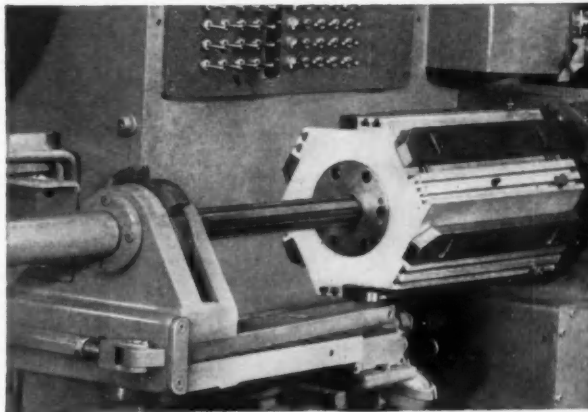
Ask your Gisholt Representative to tell you about the Fastermatic's new electric control panel...its increased capacity...its higher speeds and feeds and heavier construction. You'll also want to know about using the Gisholt JETracer on the Fastermatic. Call him today—or write Gisholt for literature...ask for Bulletin No. 1179.



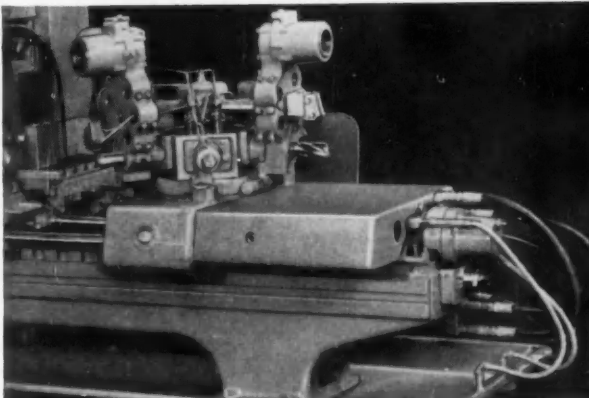
**GISHOLT JETracer**—mounts on any one of Fastermatic's turret stations. Provides exceptional accuracy for turning, boring or facing—either straight, taper or contour. Hydraulically operated; stylus follows contour of template controlling movement of single-point tool on sliding member.



**NEW GISHOLT FASTERMATIC CONTROL PANEL**—simple toggle switches govern basic machine functions, cutting initial setup time in half. Master reference card is used to cut setup time still more on re-runs.



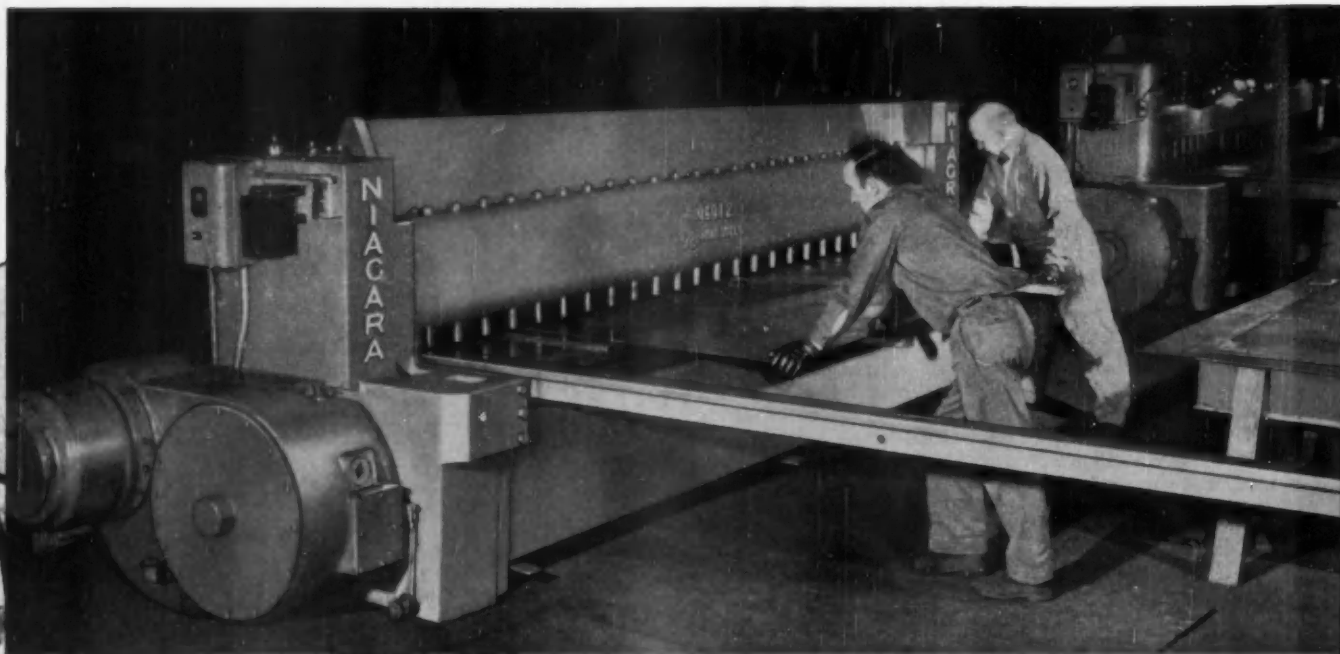
**HEXAGON FEED CONTROL DRUM**—positioning of adjustable flat bars on each face determines rate of feed. Thumbscrew actuator pins in slots on each face determine point of change from traverse to feed and length of feed.



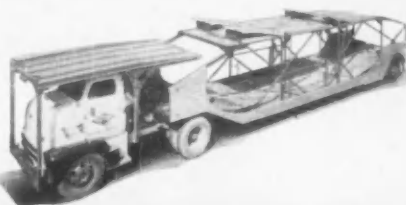
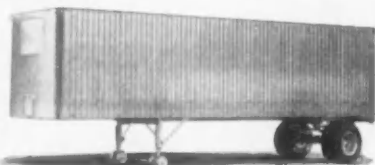
**FASTERMATIC TURRET SADDLE** is hydraulically powered for indexing and longitudinal movement. Automatic cycle easily set up with turret double- or triple-tooled. **CROSS SLIDES**—front and rear—operated by forward movement of turret saddle, can work independently, or together, with any turret face.

**IN POWER SQUARING SHEARS . . .**

# Fruehauf picks Niagara for



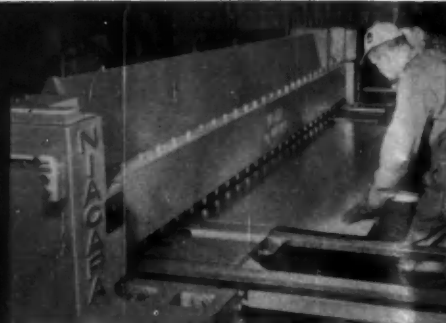
Niagara Model 912 shearing 18" x 30" transition plates from 10 gage hot-rolled steel for tank trailer frames.



Niagara Model 96 cutting forty 4" x 6" trailer gussets per minute from  $\frac{3}{8}$ " and  $\frac{1}{2}$ " bar stock.



Niagara Model 812 shearing 11 gage hot-rolled steel to 36" x 144" for trailer floor beams.



Niagara Model 812 at work shearing 24 gage stainless steel to 4' x 6'6" for van trailer door panels. Production: 2.7 pieces sheared all 4 sides per minute.

# NIAGARA

## power squaring shears

America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work.

# "exceptional machine value"

**World's largest trailer manufacturer spells out its reasons for using Niagara Underdrive Shears in producing a wide variety of parts from cold-rolled and hot-rolled steels, stainless and aluminum**

As a metal fabricator, Fruehauf Trailer Company is well-qualified to speak. It not only manufactures every conceivable type of commercial trailer, but "builds more of them than any company in the world."

So, when it comes to power squaring shears, Fruehauf is particularly qualified to speak. Using several Niagara Models, it considers them an "exceptional machine value."

Enlarging on the point, Fruehauf engineers say, "Niagara Shears are capable of holding straight lines within thousandths of an inch . . . they keep their settings . . . trouble-free, they require a minimum of maintenance."

"They're well-balanced . . . can be moved about . . . require no special concrete base. We especially like

their minimum height . . . can see over them. It's unlikely that an operator will step out from the shear in the path of a fork lift."

Like Fruehauf, progressive companies everywhere look to Niagara for exceptional machine value in a power squaring shear. Here are a few of the reasons:

**TAKE ACCURACY!** Niagara's positive, power actuated, self-compensating holddown grips work securely. Fully closed box section construction of bed, crosshead, holddown and housings resists all stresses with minimum deflection.

**TAKE SPEED!** More working strokes per minute and instant engagement of Niagara's exclusive multi-point sleeve clutch assure more cuts per hour. Full visibility of the cutting line, ease of operation, quick setting gages and safety features boost hourly output.

**TAKE MAINTENANCE!** Niagara Shears are built to stand the gaff on the toughest jobs. Simplicity of design involving a minimum number of parts, and utmost accessibility cut out costly maintenance.

Any way you look at it, Niagara has the most to offer you in modern shear performance.

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**see what America's most modern  
power squaring shears  
can do for you**



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AI

CWC  
castings  
help  
hold your  
production . . .



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Division of Textron Inc.

Muskegon, Michigan



Campbell, Wyant and Cannon, one of the nation's largest production and jobbing foundries, produces grey iron, alloy iron and steel castings of consistent uniformity—quality castings that lower production costs! Because CWC castings measure up to such exact specifications, machine shop rejects are greatly reduced . . . and time and cost consuming inspection and re-working periods are kept to absolute minimums. Here, creative metallurgical engineering, quality control and mechanized methods assure improved product performance. CWC employs spectrographic analysis of metals, radiographing by million volt X-ray and various types of pre-production planning and tests to maintain the highest quality! On-time delivery of castings keeps your operations on schedule.

**Write today for our booklet, "One Source" . . .** it illustrates and describes the many types of castings CWC is now manufacturing and the methods used to produce them.

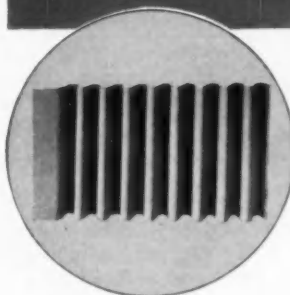
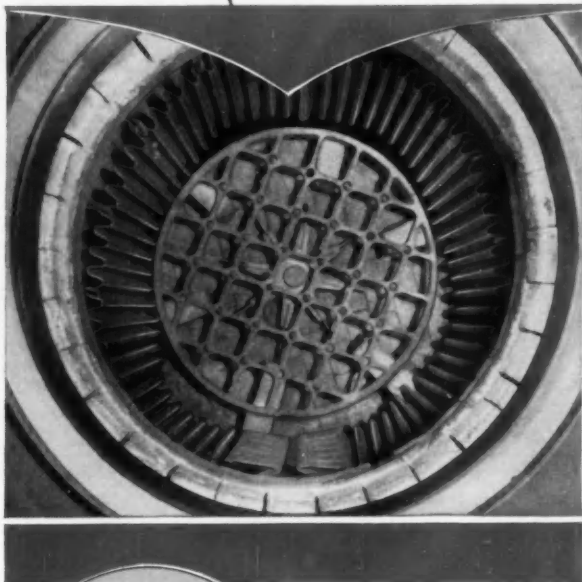
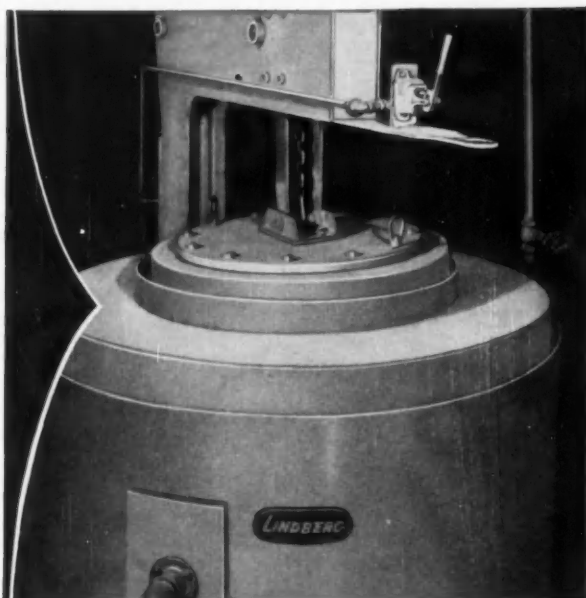
SIX FOUNDRIES LOCATED IN MUSKEGON, LANSING AND SOUTH HAVEN, MICHIGAN . . . READY TO SERVE YOU!



**FROM THE OUTSIDE**

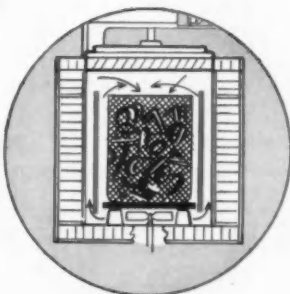
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CARBURIZING FURNACE**

***BUT LOOK INSIDE***



CORRTHERM elements operate on extremely low voltage. No leakage through carbon saturation. Shock or short hazards eliminated. No complicated mountings required. An exclusive Lindberg development.

Note how CORRTHERM elements serve as baffles to direct forced convection streams through the charge.



***No Retort!***

Because it needs no retort, this new Lindberg electric vertical pit-type furnace gives you these important advantages:

- Lower initial cost, no retort to pay for.
- No expensive retort replacement.
- Downtime for retort replacement eliminated.
- Increased production because it heats faster.
- Exact atmosphere control maintains work quality.
- Versatile, carbon-diffusing and requeenching along with carburizing. Adaptable to variety of work.

All this is made possible by Lindberg's new CORRTHERM electric heating element. For lower initial cost, lower maintenance costs, faster production, better quality control, why not look into this furnace. It's additional evidence that, if you're concerned with the application of heat to industry, better talk it over with Lindberg.

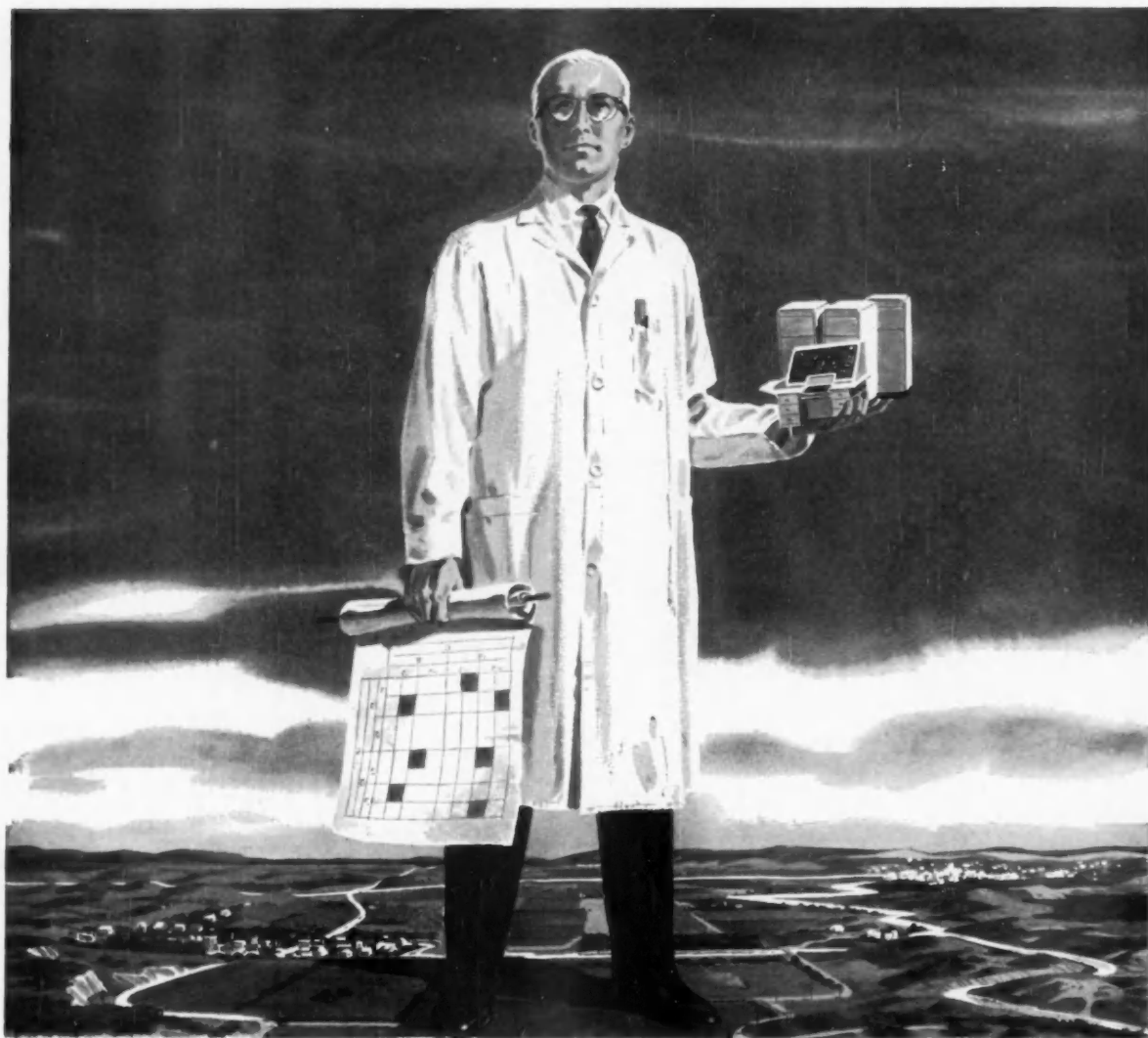
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Old, new, time-tested and visionary—National Seal engineers embrace every approach that can help keep National Seals the best engineered in America. Results have been good. Syntech®, the milestone in synthetic rubber

seals and Micro-Torc®, major forward step in leather seals, are but two examples.

National Seal's advanced engineering, in plant or field, is ready now to help you solve sealing problems. This help is yours for a telephone call.

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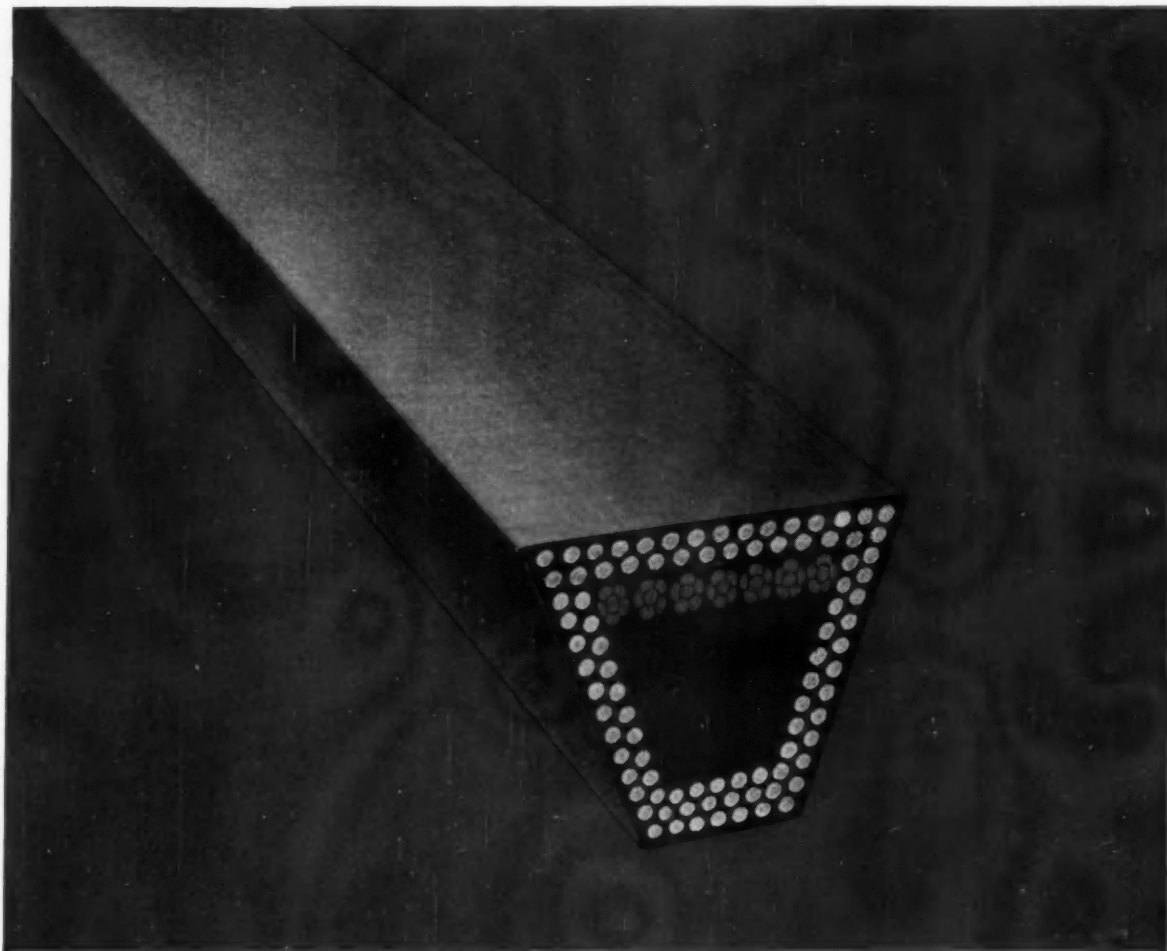
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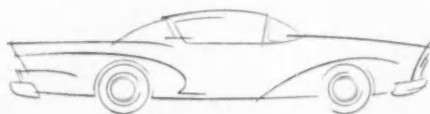




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**Quiet . . . smooth . . .  
vibration at the  
vanishing point**



Unerring electronic controls; new methods of curing; the facilities of the largest and most modern plant devoted exclusively to the manufacture of endless transmission belts—these are the factors that bring to the automotive industry the one V-belt that erases vibration to the vanishing point.

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**Mechanical Goods Division**

**United States Rubber**

## CONVAIR FURNACE-BRAZES B-58 HONEYCOMB PANELS



America's first supersonic bomber  
—the U. S. Air Force B-58 Hustler  
—on a test flight from the Fort  
Worth plant of Convair Division,  
General Dynamics Corporation.

When a bomber is designed for supersonic speeds as well as altitudes above 50,000 feet the combination of weight and strength becomes vitally important.

That's why Convair uses honeycomb "sandwich" construction for wing and fuselage panels. In producing these panels, honeycomb sections are placed in frames, faced with a silver-manganese alloy brazing foil, and then covered with skins. (Honeycombs, end closures, frames and skins are all of stainless steel.)

Assemblies are then loaded into a large alloy retort mounted on a furnace car and then travel through a brazing furnace installation designed and built by Holcroft. The result is a complete bond of all stainless steel parts.

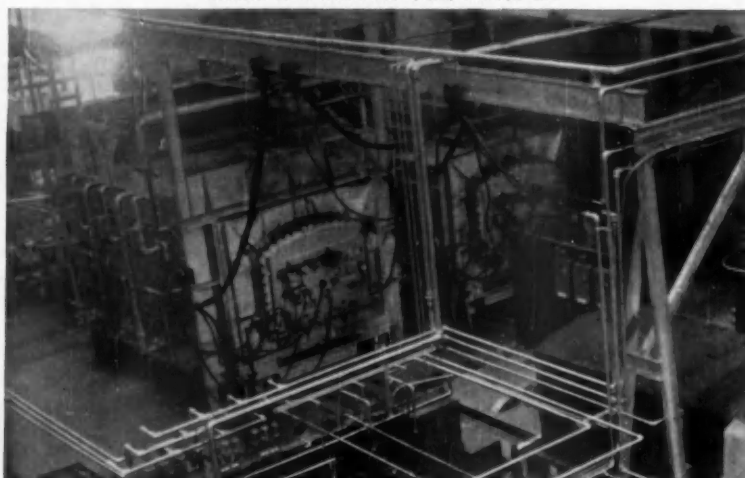
Many manufacturers are taking a tip from the aircraft industry and are applying honeycomb construction to their own products. And more and more of these manufacturers are turning to Holcroft—not only for help in developing brazing systems but for all heat treating answers as well. You can, too. Just write.

## HOLCROFT AND COMPANY



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PRODUCTION HEAT TREAT FURNACES FOR EVERY PURPOSE

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CANADA: Walker Metal Products, Ltd., Windsor, Ontario



## CALENDAR

OF COMING SHOWS AND MEETINGS

- Bendix-Scintilla International Ignition Conference, annual meeting, Sidney, N. Y. ....Aug. 20-22
- American Institute of Electrical Engineers, Pacific Meeting, Chinoook Hotel, Yakima, Wash. ....Aug. 28-30
- Leipzig Fair, Germany .....Sept. 1-8
- Farnborough Air Show, England.....Sept. 2-8
- Canadian International Air Show, Toronto, Ont., Canada .....Sept. 6-7
- American Institute of Electrical Engineers, Petroleum Industry Conference, Sheraton Hotel, Philadelphia, Pa. ....Sept. 9-11
- SAE Tractor and Production Forum, Hotel Schroeder, Milwaukee, Wis. ....Sept. 9-12
- Instrument Automation Conference and Exhibit, Auditorium, Cleveland, O. ....Sept. 9-13
- National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J. ....Sept. 11-13
- Fifth European Machine Tool Exhibition, Hannover, Germany .....Sept. 15-24
- American Die Casting Institute, annual meeting, Edgewater Beach Hotel, Chicago, Ill. ....Sept. 17-20
- American Machine Tool Distributors Association, annual meeting, Hotel Cleveland, Cleveland, O. ....Sept. 22-24
- ASME Petroleum Mechanical Engineering Conference, Mayo, Tulsa, Okla. ....Sept. 22-25
- Standard Engineering Society, annual meeting, Hotel Commodore, New York, N. Y. ....Sept. 23-25
- ASME Fall Meeting, Statler Hotel, Hartford, Conn. ....Sept. 23-25
- Material Handling Institute, Joint-Industry fall meeting, Greenbrier Hotel, White Sulphur Springs, W. Va. ....Sept. 30-Oct. 1
- SAE National Aeronautic Meeting, Production Forum, and Engineering Display, Hotel Ambassador, Los Angeles, Calif. ....Oct. 1-5
- National Electronics Conference, Hotel Sherman, Chicago, Ill. ....Oct. 7-9
- ASLE-ASME Lubrication Conference, Royal York Hotel, Toronto, Ont., Canada .....Oct. 7-9
- American Institute of Electrical Engineers, fall general meeting, Morrison Hotel, Chicago, Ill. ....Oct. 7-11
- ASME - AIME Fuels Conference, Chateau Frontenac, Quebec, Canada .....Oct. 10-12
- Pressed Metal Institute, annual meeting, Castle Harbor, Bermuda .....Oct. 13-17
- International Motor Show, Earls Court, London, England ...Oct. 16-26
- National Conference on Industrial Hydraulics, Hotel Sherman, Chicago, Ill. ....Oct. 17-18
- ASME Power Conference, Americus Hotel, Allentown, Pa. ....Oct. 21-23
- Computer Applications Symposium, Hotel Sherman, Chicago, Ill. ....Oct. 23-24
- American Society of Body Engineers, annual technical convention, Rackham Bldg., Detroit, Mich. ....Oct. 23-25
- National Industrial Packaging & Handling Exposition, Convention Hall, Atlantic City, N. J. ....Oct. 28-31
- National Metals Exposition and Congress and Second World Metallurgical Congress, International Amphitheatre, Chicago, Ill. ....Nov. 2-8



U.S. Patent  
No. 2,789,872

## What automotive engineers now know about Sealed Power's New Stainless Steel Oil Ring

*It does things no other ring can do!*

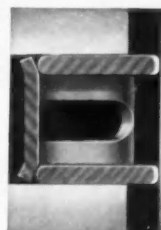
CHECK THESE DESIRABLE FEATURES—  
carbon steel rings don't have them

- holds full room temperature tension at engine operating temperature
- resists corrosion, will not pit
- sludge doesn't form on stainless steel finish
- actually hardens in use

### DETAILS OF NEW OIL RING EXPANDER-SPACER



Circumferential abutment type design makes the ring independent of depth of piston groove. It exerts pressure uniformly . . . conforms more readily to the bore.



Proper axial pressure of the rails against sides of groove assures side-sealing. This provides smoke control under high vacuum conditions.

### TWO ADDITIONAL IMPORTANT ADVANTAGES—

Chrome-faced side rails for extra long life in high compression engines—LAPPED FOR QUICK SEATING

Easy assembly—requires about 20 seconds per piston

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# Sealed Power Piston Rings

## PISTONS • CYLINDER SLEEVES

Leading Manufacturer of Automotive and Industrial Piston Rings Since 1911

Largest Producers of Sealing Rings for Automatic Transmissions and Power Steering Units

AUTOMOTIVE INDUSTRIES, August 15, 1957



**SURE, POWER STEERING  
MAKES THE JOB EASIER.  
BUT IT'S THE ADDED SAFETY  
THAT COUNTS MOST.**

**OUR POWER-STEERED  
RIGS STAY ON SCHEDULE  
BETTER, TOO.**

**EITHER WAY,  
POWER STEERING MAKES  
GOOD BUSINESS SENSE.**

## THE CASE FOR POWER STEERING ON TRUCKS!

The trend to power steering on trucks is based on one very practical reason—operators of trucks equipped with power steering have invariably found that the added safety and greater operating efficiency of their vehicles have demonstrated that power steering is indeed a sound investment.

Truck drivers using power steering report less tension and fatigue in normal driving and appreciate the positive control that blocks road shock from chuck holes and prevents loss of control if the truck is forced out on a soft shoulder.

The dispatcher knows the importance of regularly maintained schedules. He is quite aware that with power steering drivers are more relaxed and are better drivers than tired drivers. Thus, power steering not only reduces the hazard of road accidents, but helps the driver to maintain established schedules through better vehicle control.

In short, power steering, by saving time and money, contributes materially to a more profitable operation.

Truck manufacturers are always eager to offer their customers features

that will make truck operation safer and more profitable and, at the same time, give their dealers every selling advantage.

That's why more and more truck manufacturers are offering performance-proven Bendix\* Power Steering as original factory equipment.

If you would like to know why power steering for trucks is perhaps even more logical than power steering for passenger cars, we have prepared an interesting folder on the subject.

Write for your copy today. We think you'll be convinced.

\*REG. U.S. PAT. OFF.

**Bendix** PRODUCTS DIVISION **South Bend** IND.





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E. H. Miller, Advertising Mgr.  
E. W. Hevner, Circulation Mgr.  
James Cadagan, Asst. Circulation Mgr.

## REGIONAL MANAGERS

CHICAGO—William H. Baldwin

—Carl A. Zehner  
360 North Michigan Ave.  
Chicago 1, Ill.  
Phone RAndolph 6-2166

DETROIT—Melvin B. Nylund

1015 Stephenson Bldg.  
Detroit 2, Mich.  
Phone TRinity 5-2090

PHILADELPHIA and NEW YORK—

Nelson W. Sieber  
Chestnut and 56th Sts.  
Philadelphia 39, Pa.  
Phone SHerwood 8-2000  
and

100 East 42nd St.  
New York 17, N. Y.  
Phone OXford 7-3400

CLEVELAND—Richard P. Keine

930 B. F. Keith Bldg.  
Cleveland 15, Ohio  
Phone SUperior 1-2860

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909 Mercantile Securities Bldg.  
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TULSA—John W. Sangston

621 Petroleum Bldg.  
Tulsa, Okla.  
Phone LUther 4-1769

SAN FRANCISCO—Frank W. McKenzie

1355 Market St.  
San Francisco 3, Calif.  
Phone UNderhill 1-9737

LOS ANGELES—L. H. Jackson

198 S. Alvarado St.  
Los Angeles 57, Calif.  
Phone DUrnirk 7-4337

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## High Spots of This Issue

### Unique Operations on the TurboGlide Transmission

Concluding his extensive coverage of operations at Chevrolet's TurboGlide plant, the author describes in detail the production and assembly of such TurboGlide components as the transmission reverse cone and turbine elements. Page 48.

### Advancements in the Investment Casting Process

Several improvements have been made in the investment casting process by Misco Precision Castings Co. engineers. The new variations include casting metals in a vacuum, and use of ceramic shells for molds and of special cores. Page 56.

### Design Changes Less Costly with Plastics Pattern

Design changes in production equipment are costly and time-consuming, especially when the design involves cast parts. A system of patternmaking with epoxy resins, as explained in this article, facilitates making these changes. Page 58.

### The A3D Skywarrior on the Production Line

Douglas Aircraft Co. engineers responsible for turning out the A3D Skywarrior, largest and most powerful carrier-based aircraft ever built, faced a number of difficult production problems. How most of them were solved is told here. Page 64.

### Automatic Production Line for Ball Joint Assemblies

A production setup capable of supplying ball joint assemblies for the Chrysler line of passenger cars has been installed in Chrysler's New Castle, Ind., plant. The automatic production line uses the latest fabricating and conveyerizing techniques. Page 68.

### 35 New Product Items and Other High Spots, Such As:

Tractor uses air pillow for wheels; ball cups assembled in hydraulic press; GM radioactivity school; automated blasting unit; conductive silicone rubber; the solid propellant starter; gas turbine has back-to-back rotors; and industry statistics.

AUTOMOTIVE INDUSTRIES COVERS—  
PASSENGER CARS • TRUCKS • BUSES • AIRCRAFT • TRACTORS • ENGINES  
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# STAINLESS DIRECTORY

## Buyers Guide to Ryerson Stainless Stocks & Services

Here's a quick guide to the nation's largest stocks of stainless steel—2,351 sizes, shapes, types and finishes of Allegheny stainless in stock at Ryerson.

This wide selection assures you of getting the best stainless for every application. Extra care in storage, handling and shipping—such as padded shear clamps to protect finish and flatness of sheets—guards the high quality of Ryerson stainless stocks. And in addition, the help of full-time stainless specialists is yours when you call Ryerson.

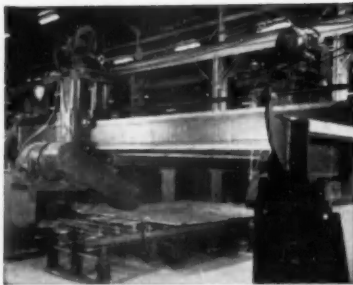
See your Ryerson catalog for a complete listing of stocks and call your nearby Ryerson plant for quick shipment of Allegheny stainless—one piece or a truckload.



**SHEETS**—11 analyses of Allegheny stainless sheets in stock including nickel and straight chrome types. Also extra wide sheets to reduce welding costs.



**PLATES**—Available in 9 analyses including plates to Atomic Energy Commission requirements and to ASTM specifications for code work. Also extra low carbon types for trouble-free welding.



**TRUE-SQUARE ABRASIVE CUTTING**  
Stainless plates up to 12' x 25' cut absolutely square on abrasive disc machine. Length and width tolerance plus or minus 1/32".



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# News

## OF THE AUTOMOTIVE AND AVIATION INDUSTRIES

Vol. 117, No. 4

August 15, 1957

### Chrysler Aims for New Record With Sales and Earnings Up

Chrysler Corp., with momentum from early acceptance of its current models carrying through the year, should set new sales and earnings records in 1957. Chrysler's first half sales and earnings were well ahead of previous highs, and the company expects a strong finish in the fourth quarter of the year.

Net sales for the six months through June 30 totaled \$2,061,047,392, a gain of 44 per cent over sales of \$1,428,779,603 for the same period last year.

Earnings for the first half of 1957 totaled \$89.7 million compared with \$18.6 million last year.

Chrysler anticipates a decline during the current quarter, due to model changeover and seasonal plant shutdowns. Chrysler's changes for 1958, however, will be minor and down time will be held to a minimum. The company is counting on its "Forward Look" styling to carry its popularity over into 1958. Advertising emphasis has been on styling during the current model year, with less mention of such features as Torsion-Aire Ride.

### Motor Products Corp. Shops For New Business Ventures

Motor Products Corp. is considering several opportunities for investing some \$11 million when liquidation of present assets is completed. R. J. Nixon, president of the Detroit firm, said there is "no restriction on the type of business it might be, and it would not necessarily be manufacturing."

Motor Products currently is winding up production at its Detroit aircraft plant on contracts with Curtiss-Wright (J-65 cone and duct assemblies) and Grumman Aircraft Corp.



### FORD BUILDS THREE-TON TRUCK FOR GERMAN ARMY

Ford of Germany is building for that nation's new army a three-ton, four-by-four truck that is a development of the standard four-wheel-drive vehicle produced for civilian use. It is powered by a 234.9 cu in. side-valve V-8 engine with an output of 92 bhp at 3500 rpm. Transmission consists of a four-speed manual gearbox with three synchronized ratios and an intermediate two-speed transmission to give eight forward and two reverse ratios in all. The truck can transport 20 men and their equipment.

(Cougar tail section). Mr. Nixon said the work should carry through 1957. A 40,000 sq ft parts plant in Hamtramck is supplying the aircraft plant.

The company's main 660,000 sq ft plant in Detroit is idle and for sale. Last month (July), Motor Products sold its Chicago Deep Freeze Div. plant for \$700,000. The company previously sold plants in Canada, Ohio, and Illinois.

### Edsel Div. Sets Sept. 4 For First Public Showing

The public will get its first look at the long-awaited Edsel car on Sept. 4, dealer announcement date. Edsel Div. hopes to have 1200 dealers displaying the car by then.

### AMC Cut Nine-Month Loss While Net Sales Declined

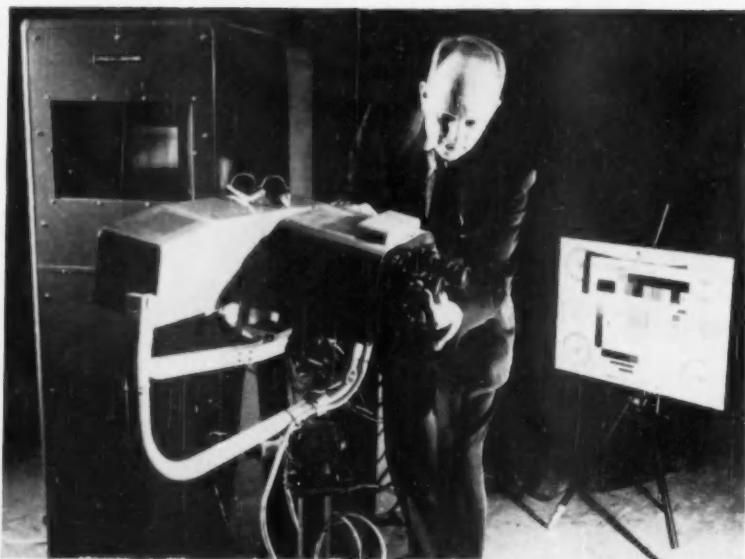
American Motors Corp.'s loss during the nine-month period ended June 30 totaled \$6,467,926, a drop from the loss of \$18,524,030 during the same period a year ago. Sales, however, also showed a decline—from \$319,841,661 a year ago to \$288,414,452 for the period just ended.

For the June quarter, net sales of \$101,492,069 topped the 1956 figure by \$7.5 million. The operating loss dropped from \$10.5 million to \$1.1 million.

The company reported Rambler sales were up 35 per cent during the period to put the Automotive Div. in a profit position. However, losses by the Appliance and Special Products Divs. affected the overall picture.

# News

## AUTOMOTIVE AND AVIATION



### GE COLOR TELEVISION DEVELOPED FOR ATOMIC WORK

This closed-circuit, three-dimensional, color television system has been developed by General Electric Co. for remote servicing of reactors used in development of a nuclear aircraft propulsion system. The color stereo system was developed to permit use of color-coded parts in reactor components. It also provides the degree of precise depth perception required for their correct positioning. The system will be used by the company's Aircraft Nuclear Propulsion Dept. at a test site of the AEC.



Courtesy of Science & Mechanics Magazine

### MEDIUM-PRICE RUSSIAN CAR EXHIBITED IN CHICAGO

This 1956 M-20 Russian Pobeda, displayed recently in Chicago, is reported to be the biggest seller in the Soviet Union today at a rate of about 28,000 units per year. It seems in appearance to represent a composite of the Plymouth, Ford, Chevrolet, and Nash models of the middle and late 1940's, while the design of the engine (inset) is similar to that of the 1942 Willys Jeep. The four-cylinder, in-line, L-head power plant has a piston displacement of 129.4 cu in., compression ratio of 6.2 to 1, and an output of 52 bhp at 3600 rpm. Three-speed transmission has manual gear shift lever.

### Army Awards Three Contracts For Aerial Jeep Development

The Army has awarded three contracts totalling \$1.702 million for the design, construction, and testing of flying research vehicles to be used in the possible future development of an "aerial jeep."

Recent developments in direct lift devices utilizing the ducted propeller, improved power plant designs, and advances in vertical take-off research, have prompted the Army to undertake the development of an aerial jeep. It would provide the Army with a compact vehicle having the versatility of the conventional jeep, but being capable as well, of hovering and propelling itself above the ground.

Ultimately, the Army hopes to have a general utility vehicle which can travel at speeds up to 50 mph, stay in the air for several hours, and carry up to 1000 lb of weapons or equipment. If successful, the concept could lead eventually to the development of an "aerial truck."

Under the contracts, flying research vehicles will be developed to explore the behavior of ducted propeller vehicles in forward flight and to determine the most promising control system. Different arrangements and configurations of ducted propellers and control systems will be investigated under the three contracts.

### Curtiss-Wright Buys Test Site In West for Development Work

The huge Curtiss-Wright aircraft empire has already acted to offset the coming cutback in orders for military aircraft. The company has bought 150 square miles of undeveloped land east of Reno, Nevada, for a vast testing laboratory.

The prime purpose of this site is the testing of rockets and missiles for the Defense Dept. However, Curtiss-Wright also plans to step up its research and development of the Zephyr—first turbojet engine to be produced exclusively for use on commercial airplanes—and other civilian-type aircraft. Testing of non-military atomic-power equipment is also slated for the new laboratory in the future.

Curtiss-Wright's growing emphasis on civilian-type products—rather than military items—shows up sharply in this comparison: commercial (non-military) sales, first-half of 1956—50 per cent of total net earnings; and commercial (non-military) sales, first-half of 1957—65 per cent of total net earnings.



### **White Motor's Sales Decline In First Six Months of 1957**

White Motor Co.'s sales for the first half of 1957 totaled \$109,817,968, a drop of more than \$2.7 million from last year's record sales. Net income for the period was \$3,350,756. Operations of Reo Motors, Inc., recently purchased by White, were included in the report only from June 5.

### **Chrysler Names Stylist Exner A Corporation Vice-President**

Chrysler Corp. director of styling Virgil M. Exner has been elected a vice-president of the corporation. Exner, who joined Chrysler in 1953, is credited with developing the current "forward look" design theme used on all Chrysler Corp. cars. New styling has been a large factor in the company's rise in sales this year.

### **Edsel Nears Full Output At Plants in Six Cities**

Edsel Div. of Ford Motor Co. will be in full production at plants in six cities when the new Los Angeles Rosemead factory starts building Edsel and Mercury cars in September. Edsel and Mercury also are sharing the Wayne, Mich., facilities.

The only plant devoted exclusively to Edsel production is at Somerville, Mass. Edsel and Ford Divs. are using the same assembly lines at Mahwah, N. J., San Jose, Calif., and Louisville, Ky.

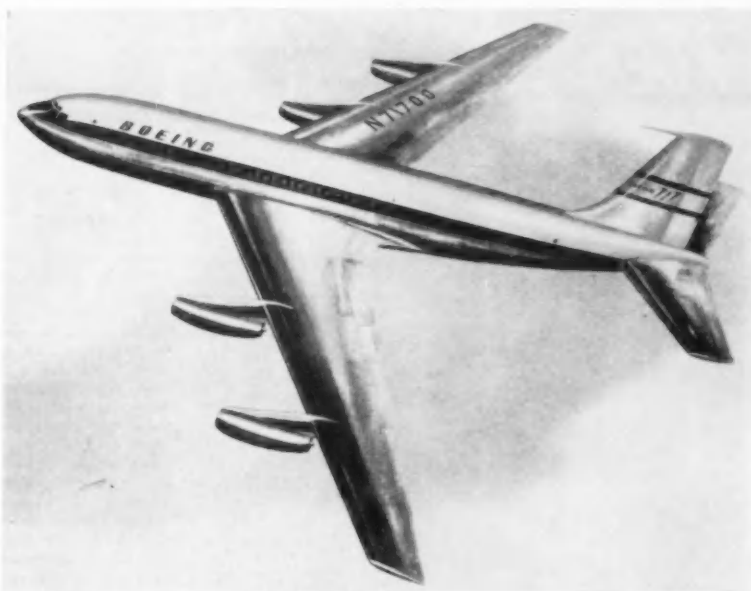
No plans have been made for disposing of Ford Motor Co.'s nine-year-old Los Angeles Plant No. 1. The new factory has 1.1 million sq ft and an annual capacity of 175,000 units.

### **Borg-Warner Sales Increase But Earnings Off in Period**

Borg-Warner Corp.'s sales during the six months ended June 30 rose nearly \$12 million, compared to the same period a year ago. However, net earnings dropped slightly, according to a recent interim report. Sales totaled \$321,624,442, and earnings amounted to \$16,974,939, a decrease from \$17,239,136 a year ago.

### **Dodge Equipping 54 Per Cent Of Trucks with V-8 Engines**

Dodge is building 54 per cent of its trucks with V-8 engines, and the division expects the percentage to rise during the latter half of 1957. Dodge first offered a V-8 engine in 1953 and



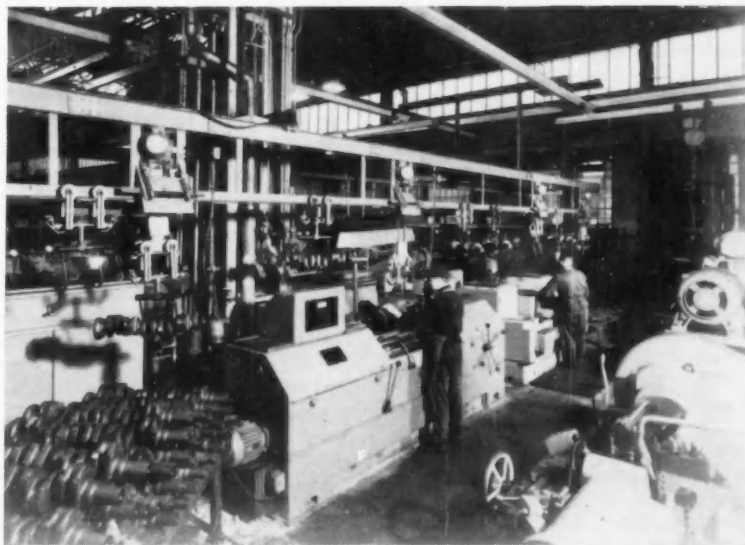
### **BOEING SHORT-TO-MEDIUM RANGE JET LINER SHOWN**

Presented above is an artist's drawing of the new Boeing 717 short-to-medium range jet airliner, the third member of the Boeing family of commercial jet aircraft. It is designed to operate economically on flights of from 200 to 1700 miles, and cruise at speeds of from 550 to 600 mph at altitudes of 25,000 to 40,000 ft. The basic configuration is designed around four Pratt & Whitney advanced JT3 engines. However, engines such as the General Electric advanced 179 and others in this power class also may be used.

The new plane is being offered to airlines for delivery sometime in 1960.

equipped 2.5 per cent of its trucks with the 145 hp engine that year. The percentage rose to 38 in 1954, and to

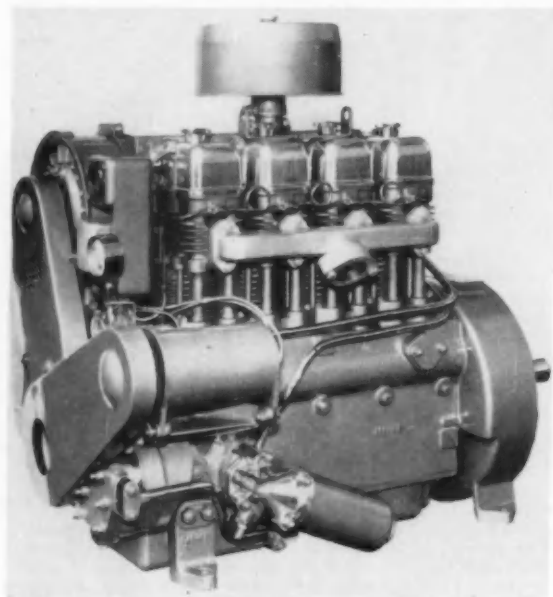
50 in 1955. Several large fleet orders specifying six-cylinder engines caused a drop to 46 per cent last year.



### **GERMAN MONORAIL CONVEYOR SPEEDS WORK HANDLING**

This new monorail conveyor, developed in Germany by R. Stahl of Stuttgart, speeds work handling economically between machine tools arranged for flow production. Workpieces are carried on individual trolleys pushed by hand along the overhead track. A short, detachable section of track above each station is lowered, together with a loaded trolley by a stationary electric hoist. Individual trolleys are automatically retained on each dropping section by gravity pawls. Maximum hoist capacity is 660 lb.





### BRITISH DIESELS

A new range of small air-cooled Diesels, introduced by Peffer's, Ltd., of England, marks its entry into the automotive field. The engines are made in one, two, three, and four cylinders with bore and stroke both three in. They develop five hp per cylinder at 3000 rpm. Aside from a high power-weight ratio, design features include: direct injection with combustion chambers recessed in the piston crowns; finned cylinder barrels of simple construction that can be rebored to take oversize pistons; optional oil cooler; and provision for clockwise or counter-clockwise rotation.

### Clark Expands Facilities In Many Overseas Markets

Clark Equipment Co. has embarked on a program of overseas expansion to give it manufacturing facilities in almost every industrialized market in the free world. The program will give Clark equity interests in 10 overseas plants within the next year.

In addition, licensing arrangements have been negotiated with four other manufacturing organizations in which Clark will not have an equity participation. These organizations are licensed to produce heavy drive unit components and torque converters for general sale, including those units required in the production of the Clark line of fork trucks and "Michigan" construction machinery.

The 10 plants abroad in which Clark's international subsidiary is acquiring equity interests will manufacture products from each of Clark's divisions—industrial trucks, construction machinery, and automotive drive unit components for heavy highway and off-the-road equipment. The facilities include one plant in Australia, two in England, two in France, one in Japan, one in Belgium, one in Germany, and negotiations are presently being conducted with two Brazilian concerns.

Plants are presently in production

making Clark products in Australia, France, Germany and Belgium—all of which have been Clark industrial truck licenses since 1950. Production in other countries will start within a year.

### More Air Force Dollar Volume Is Awarded to Small Business

Small business is getting more Air Force business each year. However, its percentage of overall expenditures is slipping.

J. Kennard Weddel, Small Business Advisor to the Secretary of the Air Force, states that smaller concerns for the last four years have been increasing their volume by about \$100 million annually. Currently, small business is getting about \$800 million a year in prime contracts, he said. Total Air Force purchases have been running at a rate of approximately \$8 billion a year.

### Torsion Bar Article Author

The article, "Torsion Bar Tests," published in the July 1, 1957, issue of AUTOMOTIVE INDUSTRIES, was prepared by Neils Hendrickson, Engineering Consultant, Vanadium Corp. of America.

### Pontiac Div. Will Celebrate 50th Anniversary on Aug. 28

Pontiac Div. marks its 50th anniversary Aug. 28. Formed as the Oakland Motor Car Co., the firm was one of the original divisions of General Motors. In 1926 Oakland introduced the Pontiac line as a companion car; and in 1931 Oakland was dropped in favor of the single line, and the company name was changed to Pontiac Motor Div.

Pontiac has produced some seven million cars in its 50 years, with about 6.5 million of them bearing the Pontiac name. Since World War II, 3.9 million Pontiacs have been built.

### German Vehicle Production, Exports to U. S. Skyrocket

West Germany's rise to the top in European car and truck production and export is watched with increasing interest by the U. S. Government.

The reason for the added attention is the growing importance of German vehicle sales in this country. In 1955, says the Commerce Dept., the Germans sold 39,903 vehicles here. Last year, that figure had climbed to 64,140 units. Now, the Germans are working to double that number in the near future.

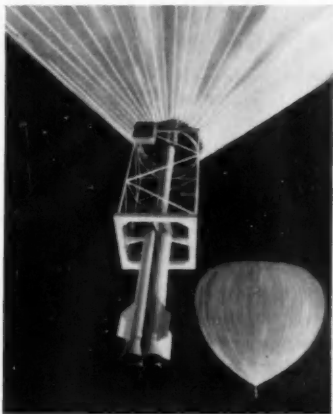
All foreign sales of West German vehicles amounted to 484,598 units, or 45.4 per cent of the total manufactured, in 1956. This places U. S. sales at 13.2 per cent of the total number of exported vehicles.

While doing extensive exporting, West Germany also imports vehicles, although in small numbers. The country brought in 29,483 units in 1956, for a 41 per cent increase over imports in 1955. This year, the Germans expect more severe competition in both the domestic and export fields.

### Japanese Firm to Produce 4140 More Willys Jeeps

Mitsubishi Heavy-Industries, Reorganized, Ltd., of Nagoya, Japan has received a new order to produce 4140 jeeps for the Japanese Self-Defense Forces. Delivery is scheduled to begin in October and continue through Feb., 1959.

Mitsubishi is licensed by Willys-Overland Export Corp. to build the vehicles, and already has delivered more than 10,000 jeeps in the last four years. The new contract, totaling \$7,838,000, was made with the U. S. Army Procurement Agency, which will turn the jeeps over to the Japanese forces.



At the launch altitude for the Far Side rocket vehicle—100,000 ft—the 3.75 million cu ft balloon is fully inflated to its maximum diameter of 200 ft. The Far Side vehicle will be launched vertically through the apex of the balloon. The size relationship of the balloon and the vehicle is indicated in the full view of the complete assembly shown at lower right in the photograph.

### Ford Subsidiary To Launch High Altitude Data Rocket

Aeronutronics Systems, Inc., a Ford Motor Co. subsidiary, will launch a rocket sometime this Fall to gather information on atmospheric and space conditions at high altitudes. Six flight tests are scheduled for late September, with the actual launching after that.

The four-stage rocket vehicle, using a combination of 10 solid propellant rockets, will carry a 3.5 lb instrument package. The latter will transmit measurements of cosmic rays and other data to ground receiving stations.

Aeronutronics is prime contractor on the program. General Mills developed the 1500-lb balloon which will be used to hoist the rocket to 100,000 ft before firing. The first and second-stage rockets are Recruit rockets developed by Thiokol Chemical Corp. The third and fourth-stage rockets are the Arrow II type and were developed by the Grand Central Rocket Co. of Mentone, Calif.

The program, called "Operation Far Side," is sponsored by the Air Force Office of Scientific Research.

### Ford 1958 Model Change Will Cost \$185 Million

Ford Div. is spending \$185 million on the design, styling, engineering, and tooling for its 1958 model passenger cars. Last year, Ford spent \$209 million to bring out the current models.

# AI TABLOID

Reliance Electric & Engineering Co. and Master Electric Co. have received shareholder approval for their combination.

\* \* \*

Keuffel & Esser Co. celebrated its 90th anniversary July 19.

\* \* \*

Kelsey-Hayes Co. has purchased Control Specialists, Inc.

\* \* \*

Armstrong Cork Co. has launched an aggressive program for the development of major new products and markets. . . . Metal & Thermit Corp. has begun a long-range research program to develop new ways of producing pure metals.

\* \* \*

Westinghouse Electric Corp. will build a new manufacturing and repair plant in Charlotte, N. C.

\* \* \*

George K. Garrett Co., Inc., is now located in its new 280,000 sq ft one-story building on Torresdale Ave. at Tolbut St., Philadelphia 36, Pa.

\* \* \*

Fruehauf Trailer Co. has formed a new Research and Development Engineering Dept. in its Missile Products Div.

\* \* \*

General Dynamics Corp. and Liquid Carbonic Corp. are holding discussions on a possible merger. . . . Industrial Enterprises, Inc., and United Specialties Co. are planning a merger.

\* \* \*

B. F. Goodrich Co. has purchased 125,000 sq ft of land in New Orleans, La., and will construct a modern distribution center on the site.

\* \* \*

Allis-Chalmers Mfg. Co. has announced a new hydraulic seven cu yd struck, 9.5 cu yd heaped, 12-ton payload, Model TS-160 motor scraper rated at 155 hp.

\* \* \*

Boeing Airplane Co. has placed a contract with Vickers, Inc., for hydraulic pumps to operate the flight control and the utility hydraulic systems of the B-52 bomber.

Rezolin, Inc., began its 20th year in the plastic tooling industry last month. . . . Tenney Engineering, Inc., is celebrating its 25th anniversary this year.

\* \* \*

Republic Aviation Corp. has developed a new low-cost aerial refueling system.

\* \* \*

Firestone Tire & Rubber Co.'s new Airide Spring plant in Noblesville, Ind., went into full-scale production on July 15.

\* \* \*

Cold Metal Products Co. has received the approval of its shareholders for the transfer of its assets and business to Jones & Laughlin Steel Corp.

\* \* \*

U. S. Steel Corp. will undertake a major construction program this fall at its Duquesne, Pa., Works.

\* \* \*

Dow Chemical Co. plans to build an acrylonitrile plant early next year at Freeport, Tex.

\* \* \*

Thor Power Tool Co. has acquired Drying Systems, Inc., producer of industrial ovens and process air conditioning installations.

\* \* \*

Jones & Laughlin Steel Corp. has opened a sales office in Youngstown, O. . . . Vickers-Sperry of Canada, Ltd., has established a new sales and service office in Montreal, Canada.

\* \* \*

Westinghouse Electric Corp. has been awarded a contract to build generating and control systems for the B-58 Hustler bomber.

\* \* \*

Charles Engelhard, Inc., has developed an automatic reigniter to eliminate the dangers of jet engine flameout.

\* \* \*

General Electric Co. has developed a lighting system said to be capable of producing better than 1000 footcandles of working light.

\* \* \*

Acme Steel Co. has broken ground at Riverdale, Ill., for a new \$23 million steelmaking plant. . . .

(Turn to page 155, please)

# News

## AUTOMOTIVE AND AVIATION



### LANCIA MODELS

Here are two of the latest Italian Lancia models. The Appia four-passenger car (top) is powered by a four-cylinder engine of 63 cu in. displacement with compression ratio of 7.4 to 1 and an output of 38 bhp at 4800 rpm. The Aurelia Strong Tourism 2500 (lower photo) is powered by a V-6 engine with a displacement of 154 cu in., compression ratio of 8 to 1, and output of 118 bhp at 5000 rpm.

### AMC Tooling to Reintroduce Car With 100-in. Wheelbase

American Motors Corp. will go after a larger share of the small car and fleet markets during 1958 with its new 100-in.-wheelbase economy sedan (see AI, June 15, p. 72). The company is tooling for the short car, and production is expected to begin in late Fall. The small model, still unnamed but probably a Rambler version, will be introduced after the regular 1958 model announcement.

In both size and price, AMC's new car will fit between the English-built Metropolitan and the regular 108-in.-wheelbase Rambler, which accounts for some 92 per cent of current AMC production. The last year (1955) AMC had a 100-in.-wheelbase car it tallied 25.1 per cent of all Rambler sales.

### AC Spark Plug Missile Plant Runs to \$10 Million in Value

The new plant construction that AC Spark Plug Div. of General Motors Corp. is doing in Oak Creek, Wis., has a value of at least \$10 million. This figure was disclosed by the Office of Defense Mobilization, which has approved an accelerated tax authorization for a \$10.193 million guided missiles plant.

AC Spark Plug began construction a year ago on a plant of 215,000 sq ft of floor space on the Oak Creek

site. At that time, an AC official said that the plant would cost more than \$5 million.

Only in June did the division announce that an addition of 135,000 sq ft would be started immediately on the Oak Creek plant. No cost figure was disclosed.

### Auto-Lite Sales and Earnings Increase in First Half of '57

Electric Auto-Lite Co. sales for the first half of 1957 were \$151,852,214, up 29 per cent over the same period last year. Net earnings for the first half were \$6,410,442 against \$2,421,306 in the like span a year ago.

The company also reported that a major portion of the sales increase was in initial equipment for new automobiles, but that there were also substantial increases in defense and replacement sales.

### Ford Building Boiler House At Its Highland Park Plant

Work began Aug. 1 on a new boiler house at Ford Div.'s Highland Park plant. The 90 by 66 ft building, part of \$6.7 million modernization program at the plant, will house four 50,000-lb-per-hour steam boilers fed from a 300,000-gallon fuel oil tank. The boilers will be producing by the middle of next year.

### Rumors Link U. S. Manufacturer With German Small Car Firm

One of the U. S. automobile companies is rumored to be negotiating with Auto Union GmbH of Dusseldorf, West Germany for purchase of the German firm. Auto Union makes the three-cylinder, two-cycle DKW passenger car and a line of small trucks.

The arrangement would give the American company a small car to market in this country. DKW, a front-wheel drive vehicle, has a two-door hardtop, a four-door sedan and a station wagon, all of them four-passenger models. Current prices range from below \$2000. In 1956 a total of 1176 DKW cars were registered in the U. S.

### Small Gas Turbine Engine Is Developed by Kollander

Kollander Engineering Co., Inc., of Albuquerque, N. M., has recently released data on a reactor-type gas turbine engine now undergoing testing and development.

A small model of the engine presently being tested (rotor size is only 3.625 in. in diameter by 4.5 in. in length) is said to develop over 5 bhp at less than 10,000 rpm. Different types of fuel have been tested ranging from gasoline to lubricating oil.

The model now being tested used standard compressors and accessories whenever possible. It does not employ a regenerative cycle that is incorporated in a second and larger model being designed.

The second experimental model of the Kollander engine, to be constructed after minor design changes, utilizes a rotor 8 in. in diameter by 12 in. in length. The second model is expected to develop 85 bhp at 8000 rpm.

### Durez Plastic to Be Used In Ford Plating Machines

Plastic made in North Tonawanda, N. Y., will be used in two of the largest rack-type plating machines ever built. These fully automatic straight-line machines, more than 700 ft long, will plate bumpers in the Ford plant at Monroe, Mich.

They include 80 motor generator sets and a ventilation system that can move more than 700,000 cu ft of air every minute. This ventilation system uses large amounts of plastic ductwork built of Hetron reinforced with layers of glass fiber mat. Hetron is a polyester resin plastic made by the Durez Plastics Div. of Hooker Electrochemical Co. in North Tonawanda.

### Cellular Plastics Production To Hit 29 Million Lb in 1957

Production of cellular plastics amounted to about 16 million lb in 1956 and is expected to reach approximately 29 million lb in 1957 for a 55 per cent increase over last year. These estimates were made recently by Dr. Paul C. Roach, chairman of the Cellular Plastics Div. of The Society of the Plastics Industry, Inc.

Cellular plastics, otherwise known as foamed plastics, are produced from basic resins such as vinyl, urethane, and polystyrene. Flexible foamed plastics are used to an increasing extent as cushioning and seating materials in buses, aircraft, automobiles, and other applications. Rigid foams are used principally for many types of insulation, packaging, marine applications, etc.

### Long Mfg. Div. Closes One Plant, Curtails Operations At Second

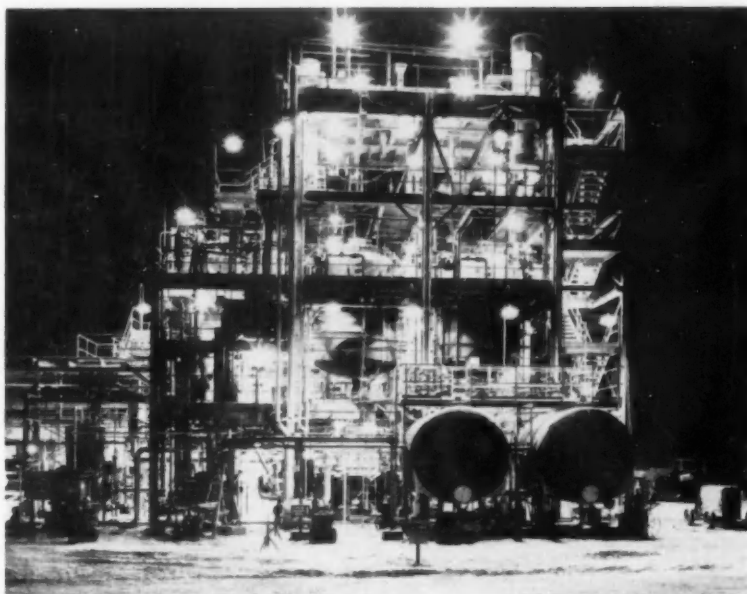
Long Manufacturing Div. of Borg-Warner Corp. has closed one Detroit plant and is cutting production at another because of reduced orders. The French Road plant, which made farm tractor transmissions and axle assemblies, has shut down, and Long is not renewing its lease on the property.

Production of automatic transmissions at the company's Kercheval plant will continue at a reduced pace, with only about 200 employees compared with a former peak of 825. Long has one other plant operating in Detroit, which produces automotive clutches, torque converters and radiators.

### Army to Control Production At New Martin Orlando Plant

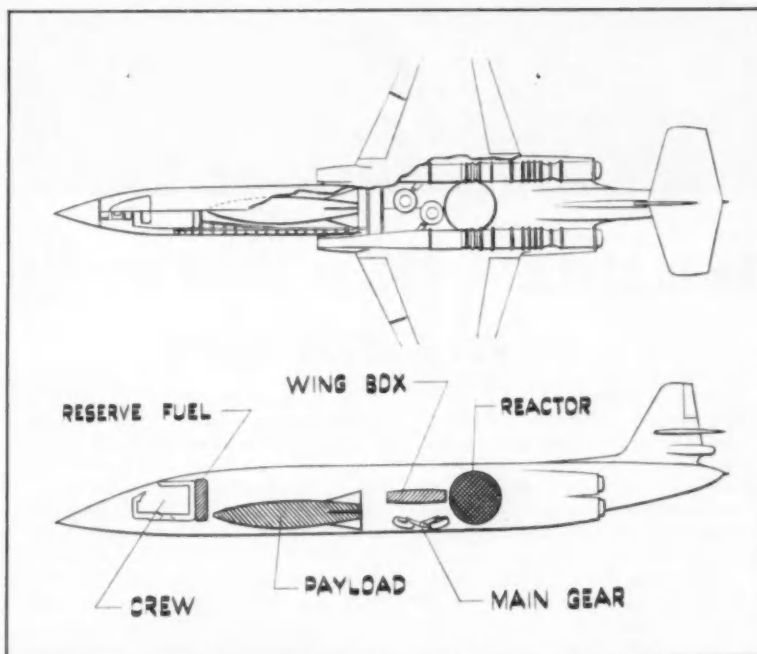
The Army will have "mobilization cognizance" over a new guided missile and small weapons systems facility now being built by Martin Co. near Orlando, Fla. "Mobilization cognizance" is a term used to describe a situation where one service is given the responsibility for scheduling all mobilization defense production in a specific plant.

The Orlando plant is scheduled for completion this Fall. Martin technicians are already turning out Lacrosse field artillery guided missiles for the Army in temporarily rented buildings at Orlando. Missiles and small weapons systems for the other military services also will be produced at the plant.



### DU PONT HYPALON PLANT SWINGS INTO OPERATION

Here is a dramatic night-time photo of DuPont's new 15-million-lb-capacity plant for the manufacture of Hypalon synthetic rubber at Beaumont, Texas. Hypalon is a special-purpose rubber that resists ozone and oxidation. Commercial uses include: white sidewalls on tires; tank and hose linings; fabric coatings; and preventive maintenance coatings. The synthetic rubber was formerly produced at Du Pont's Belle Works.



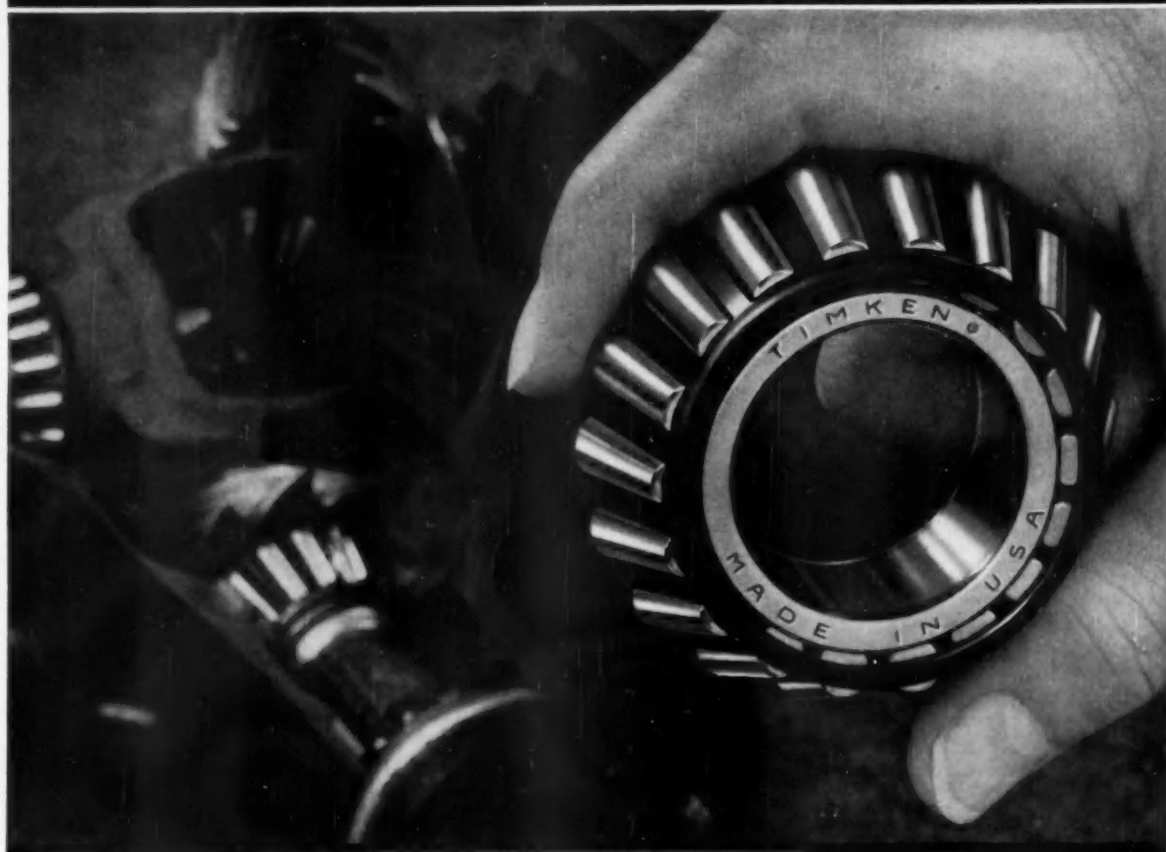
### NUCLEAR-POWERED AIRPLANE PROJECTED IN SKETCH

These drawings, prepared by scientists of Lockheed Aircraft Corp., convey a general idea of what the nuclear-powered airplane may look like when it is built for the Air Force. Illustration at top shows the power plant inside the fuselage, instead of on the wings. Drawing below, a side view, shows the crew compartment far removed from the atomic reactor. Problem of protecting crew from radiation is nearing solution.



*Meeting the big change in cars with the big change in bearings:*

## **TIMKEN® and The Moto-Mated Way**



### **How to save up to 15% on pinion bearings ... and get a better bearing**

**C**ARS have changed in a big way, placing new demands on component parts. Meeting the challenge of new styling, increased power and greater loads of driving is a whole new breed of Timken® tapered roller bearings. It's the product of a new concept in bearing design, manufacture and supply—mated to automakers' needs—the Moto-Mated Way. With it we recommit our 57 year partnership with the auto industry.

The new Timken Moto-Mated bearings are smaller to permit more compact designs. Lighter to cut unsprung weight, improve the ride. Capacity-packed to take the heavier loads of today's cars. And because they're produced in the most modern bearing factory in the world, new Timken Moto-Mated bearings cost less than pre-

vious designs—save users' money.

Already 23 million new Timken Moto-Mated bearings have been used by the auto industry in car front wheels alone—saving them up to 14.6% in bearing cost. And by adopting the new bearings for pinions, savings of 15% over previous designs are being realized. As use of the new Moto-Mated bearing sizes increases in pinions, differentials, rear wheels and steering gear, we can pass along our manufacturing savings to you.

Timken Moto-Mated bearings come in 13 standard sizes, simplifying design problems. Write for details on how they can save you money. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".



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**TAPERED ROLLER BEARINGS**

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# MEIN

## IN THE NEWS



*Enjoy Co., Inc., Market Development Div.—Richard M. Howlett and Charles E. Farnsworth have been made senior market development engineer and assistant manager, respectively.*

**Studebaker-Packard Corp.**—Clifford W. MacMillan was named director of industrial relations.

**New Departure Div., General Motors Corp.**—Frederick J. Garbarino has been named director of sales and engineering; Richard H. Valentine, chief engineer; Raymond O. Oyler, general sales manager; and Robert T. Collins, director of quality control.

**Illinois Tool Works**—James R. Russell has been elected treasurer.

**Borg-Warner Corp.**—Tom Conway has been named director of manufacturing services.

**Mercury Div., Ford Motor Co.**—Harry L. Swan has been appointed manager of the Advertising Dept.

**Chrysler Corp.**—John J. Di Cicco has been appointed director of pre-production planning and analysis.

**International Harvester Co.**—Brooks McCormick has been elected an executive vice-president.

**Dunlop Tire & Rubber Corp.**—J. Michael Billane has been named president and treasurer.

**Bendix-Westinghouse Automotive Air Brake Co.**—Frederick G. Reiter and Floyd L. Wheaton were elected vice-presidents.



*Waukesha Motor Co.—Clarence W. Hahn has been named production manager.*

*Lincoln Div., Ford Motor Co.—Robert R. Nadal was named general sales manager.*



**Electric Storage Battery Co.**—Monroe G. Smith has been named general manager of Exide Industrial Div.; William C. Leingang, general manager of Stokes Molded Products Div.; and H. R. Trees, general manager of the Automotive Div.

**Allis-Chalmers Mfg. Co.**—Harold S. Silver has been named general attorney.

**Ray-O-Vac Co.**—Elmer B. Ott was elected president; Donald W. Tyrrell, board chairman; and Harry J. Mason, vice-president for research and development.

**Rockwell Spring & Axle Co.**—Charles A. Cooper has been elected vice-president.

**L. A. Young Spring & Wire Corp., Ottawa Steel Div.**—Ivan K. Knight was named general sales manager.

**North American Aviation, Inc.**—John B. Pearson, Jr., is now director of development planning.

**American Brakeblok Div., American Brake Shoe Co.**—Rudolph F. Utermohlen was named manager of replacement sales.

**Cleveland Cap Screw Co.**—David G. Kelton is now an assistant general sales manager.

**Wales-Strippit Co.**—Robert L. Strawbridge has been appointed vice-president and general manager, and Russell A. Johnson has been made sales manager.



*Pesco Products Div., Borg-Warner Corp.—Richard A. Powley was appointed president.*



*Standard Pressed Steel Co., Aircraft Div.—Bennett D. Jones, has been advanced to the technical director, and Frederick D. Fernler has been named manager of the new Nut Dept.*

**Electric Auto-Lite Co., Foundry Div.**—R. W. Munger has been named operating manager, and R. M. Sellers has been made sales manager.

**American Steel & Wire Div., U. S. Steel Corp.**—George A. Pyle was appointed assistant manager of stainless steel products sales.

*(Turn to page 155, please)*

### Necrology

**Roger W. Straus**, 65, retired chairman of the board of American Smelting and Refining Co., died July 28, at New York, N. Y.

**Edwin D. Scott**, 62, retired chief body engineer for Ford Motor Co., died July 22, at Redford Township, Mich.

**John H. Kinsey**, 64, retired director of salaried personnel for Fisher Body Div. of General Motors Corp., died July 28, at Atlanta, Mich.

**Walter B. M. Brownlie**, 60, manager of the Tarrytown, N. Y., plant of Chevrolet Motor Div. of General Motors Corp., died July 30, at Lakewood, N. J.

**Clifford J. Clark**, former assistant general superintendent of Chrysler Div. of Chrysler Corp., died July 20, at Albion, Mich.

**William B. Clayton**, 69, a former commercial vice-president of General Electric Co., died July 31, at Dallas, Tex.

# # 100,000



57-49

## Proof of Precision: This 100,000<sup>th</sup> Spindle

... that's right. Ex-Cell-O has produced more than 100,000 precision grinding and boring spindles. They are in use today throughout the world, on a wide variety of important jobs. No other spindle manufacturer has so solid a record for satisfaction—so sound a reputation for building the best.

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MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS •  
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# RBW FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY



## Technical-ities

By John S. Davey

### Nuts — their use and abuse

With bolts tightened to high load levels, nut performance becomes critical.

A nut produces bolt tension by rotating and advancing on the bolt threads. To do this, there must be a mating condition of threads, which is influenced by thread lead. Lead is a matter of tolerance only before bolt is stressed. When tightened, the nut is then under compression and threads tend to contract; the bolt is in tension, and threads tend to stretch. Lead of thread is affected—elastically before yield point, permanently beyond it.

This shortening of one lead and lengthening of the other has two effects. (1) The load distributes unequally along the threads (2) Torsion on bolt increases. Something has to give. For high tensile bolts especially, it is better for the nut to do so. A nut therefore should be soft enough so that it deforms plastically and compensates for off-lead. If it does, it distributes the load and can advance to increase tension.

#### "SOFT" NUTS DO MOST JOBS

"Soft" nuts do adjust more readily than hard ones under these severe conditions. While such nuts may not be as strong in shear as heat treated ones, the important point is the bolt tension they produce. As long as the nut can pull the bolt well into its plastic range, it is doing more than its share of the job.

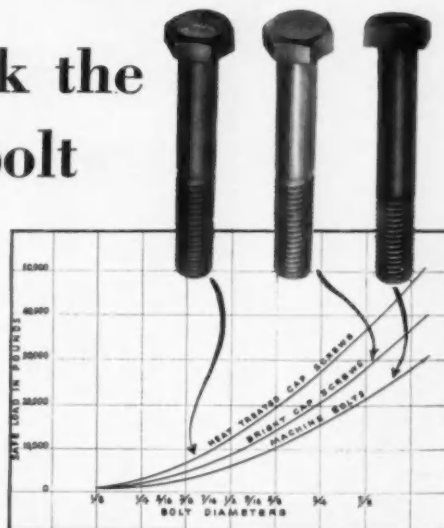
## How to pick the right size bolt

ALMOST all bolt and cap screw strength requirements can be satisfied from three types of standard fasteners without recourse to costly special alloys. In the widely used middle range of sizes, the problem is one of deciding which makes the best joint, or which proves the most economical for the job.

### MORE FOR LESS

Suppose, for example, you need a bolt safe for 20,000 pounds of loading. As the chart shows, you could use an RB&W  $\frac{3}{8}$ " square-head bolt, a  $\frac{3}{4}$ " bright cap screw, or a  $\frac{5}{8}$ " heat treated one.

If you have a lot of holes to fill, use the larger, lower strength fasteners. But to cut down number of bolts, or their size (and therefore cost), go to the higher tensiles. However you gain nothing if you don't tighten high tensile bolts to their full strength.



When it comes to uniformity of dimension, quality of head and thread, and ease of assembly, all RB&W cold headed fasteners are the same. They differ mainly in tensile strength as shown here.

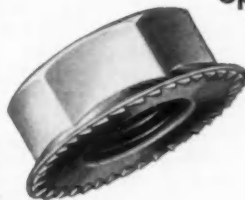
### HOW COSTS COMPARE

In terms of holding power: For each \$1.00 in high tensile bolts, it costs \$1.50 to provide equivalent clamping force with bright cap screws; or \$1.65 with machine bolts.

For more suggestions on fastener economy or for copy of above curves, write Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N.Y.

**Plants at:** Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. **Additional sales offices at:** Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

## Spin-Lock Nuts dig in to stay tight



The photograph shows the many hardened "anchors" on the flange of a Spin-Lock Nut. These "ratchet-action" teeth require 20% more torque to loosen than to tighten. They bite in as the nut turns down on its seat. Like Spin-Lock Screws, these nuts can stay put in products subject to vibration and cyclic temperature variations. Send for bulletin.

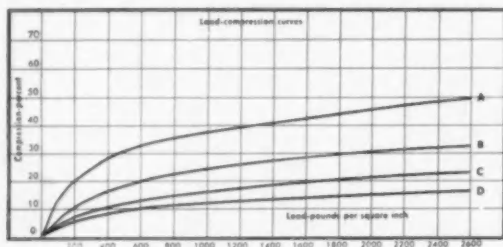
# Accopac fiber gaskets offer new high in sealing efficiency

New materials seal at higher temperatures under light or heavy flange loads

The new, expanded line of Accopac® materials brings an entirely new degree of sealing efficiency and dependable performance to a wide range of fiber sheet gasket applications.

Where flange pressures are in the range of 800-2000 psi, there are Accopac compositions that contain cork for added compressibility and sealing efficiency at these relatively low unit loads. For heavy-duty jobs, where flange pressures are 2,000 psi or higher, there are other, more dense Accopac materials that contain no cork.

All Accopac compositions are made by an exclusive patented process, in which individual fibers are coated with a synthetic latex binder before the sheet is formed. This assures uniform distribution of binder and fibers, and the result is a strong, homogeneous material.



A major advantage offered by this process is that Accopac materials have unusual dimensional stability. Accopac gaskets won't shrink or grow in the flange—or in storage—because their synthetic binders are non-extractable and will not vaporize even at temperatures up to 250° F.

There are Accopac compositions made to meet virtually any combination of operating conditions. The chart below briefly describes various Accopac cellulose fiber materials and shows their characteristics and suggested uses. For more information, write Armstrong Cork Company, Industrial Div., 7008 Imperial Ave., Lancaster, Pa.

## Accopac cellulose fiber gasket materials

GENERAL CHARACTERISTICS	TYPE	CURVE	COMPOSITION, CHARACTERISTICS, AND USES	COMPRESSIBILITY % 1,000 PSI	MINIMUM TENSILE AMD (PSI)
FOR FLANGE PRESSURES FROM 800-2,000 PSI For increased sealing efficiency at these relatively low unit loads, there are three Accopac materials that contain finely ground cork. These materials seal under bolt pressures as low as 800 psi and are recommended for applications where flange pressures are up to 2,000 psi and where temperatures do not exceed 250° F.	CS-301	A	Used to seal certain greases, high aniline point oils, water, and other services not involving aromatic fuels. Highly compressible material containing finely ground cork. Styrene-type (Buna S) rubber binder. Underwriters' approved.	30-45	800
	CN-705	A	Generally suitable for sealing lighter petroleum distillates (including gasoline) and water services. Highly compressible. Nitrile-type (Buna N) binder. Underwriters' approved.	30-45	1,000
	CN-808	D	This is a pre-compressed material in which the natural interstices have been closed by pressure. It seals at flange pressures as low as 800 psi. Generally suitable for sealing lighter petroleum distillates and water services. Nitrile-type (Buna N) binder.	5-15	2,200
FOR FLANGE PRESSURES OVER 2,000 PSI For heavy-duty flanges, where bolt pressures are 2,000 psi or higher, there are Accopac materials that contain no cork. These are dense formulations designed to take heavy loads with minimum extrusion and loss of bolt torque. Where temperatures do not exceed 250° F., they offer an economical substitute for compressed asbestos sheet packing.	N-820	C	Very high quality material recommended for heavy-duty flanges where bolt torque loss and extrusion must be held to minimum. Dense composition with low compressibility. Contains mineral filler. Nitrile-type (Buna N) binder.	10-20	3,000
	N-852	B	A low-cost, medium-density material recommended for medium to heavy-duty flanges. Moderate oil resistance. Binder is blend of synthetic rubbers, including nitrile-type (Buna N).	17-27	1,800
	N-854	B	A medium hard, oil-resistant composition for use with high flange pressures. Contains special mineral filler and nitrile-type (Buna N) binder.	15-25	2,500
	D-856	B	Recommended for medium to heavy flange pressures in services where chloroprene-type (neoprene) binder is preferred.	17-27	2,000

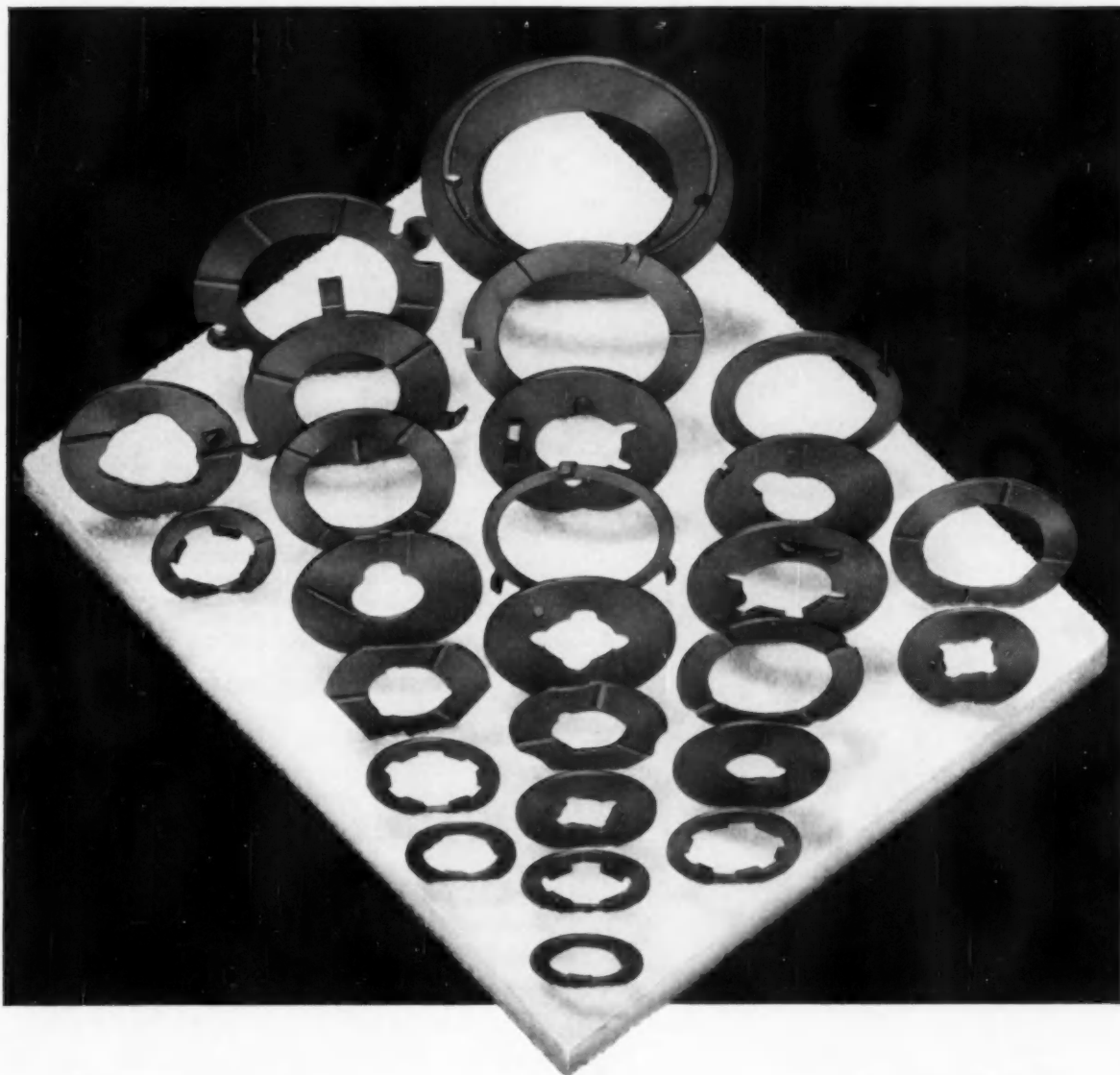
\*Tested per ASTM D1147-53T

You'll find additional helpful information on the whole line of Accopac fiber sheet gasket materials—including the new Accopac asbestos fiber materials—in this new folder.



## Armstrong ACCOPAC

... used wherever performance counts



## Variety in Precision Thrust Washer Design

Because of specially designed equipment incorporated in our manufacturing facilities, many design variations are possible in our cold-rolled thrust washers. Made of bronze, or steel with bronze on one or *both* faces, they can incorporate special holes,

grooves, nibs, scallops or lugs, as required. They can be flat, spherical or special shapes, and from 1" to 6" O.D. Cold rolling provides exceptional hardness for heavy duty. We have large capacity and provide complete engineering service. Address:



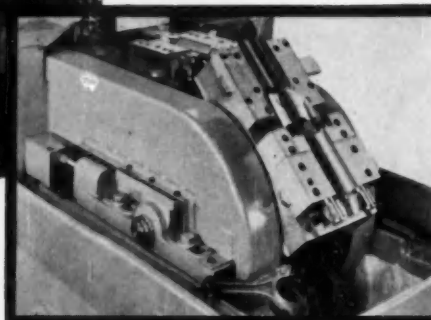
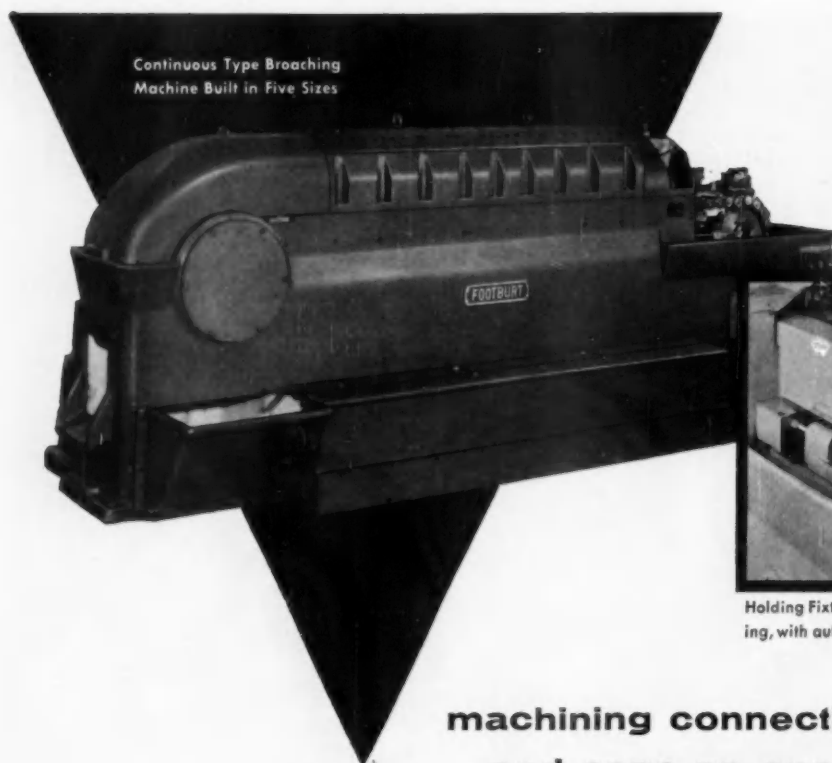
# FEDERAL-MOGUL DIVISION

FEDERAL-MOGUL-BOWER BEARINGS, INC., 11037 SHOEMAKER, DETROIT 13, MICHIGAN

RESEARCH • DESIGN • METALLURGY • PRECISION MANUFACTURING



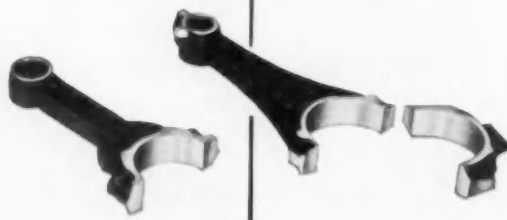
Continuous Type Broaching  
Machine Built in Five Sizes



Holding Fixtures are designed for quick, convenient loading, with automatic clamping, unclamping and unloading.

**machining connecting rods  
and caps an opportunity for**

# **S** *urface broaching*



Surface Broaching is a modern machining method that in many cases shows reduced costs through higher production, finish to closer tolerance, and low tool maintenance costs. If you machine large quantities of duplicate parts we will be glad to work with you on the possibility of adopting Footburt Surface Broaching Machines. Send us blueprints and hourly production requirements for our recommendations.

**THE FOOTE-BURT COMPANY CLEVELAND 8, OHIO**

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.....Write for Circular No. 503.....

# **FOOTBURT**

**PIONEERS IN SURFACE BROACHING**



## Over 225 blue-eyed Indians roam NAVAJO trail with ROADRANGER® Transmissions

The Indian sign for fast, efficient motor freight transport is found on the highways  $\frac{3}{4}$  of the way across the nation! Navajo Freightlines, Inc. of Denver, sends more than 225 Autocar, White-Freightliner, Diamond T, and International tractor equipped rigs—most of which are equipped with Fuller 10-speed R-96 ROADRANGER Transmissions—over 30 million miles of Navajo trail annually.

Bill Gregory, Maintenance Superintendent of Navajo's Denver Division, says: "We like the Fuller

10-speed R-96 ROADRANGER Transmission for its simplicity, easy shifting and ability to provide 10 forward speeds in the shortest possible dual drive tractor."

The R-96 ROADRANGER, with 10 selective ratios evenly and progressively spaced in short 28% steps, gives Navajo drivers *complete control* of every situation . . . provides the flexibility of operation required to meet every varying condition of time, traffic and terrain. It makes Navajo drivers safer on the trail.

You too can profitably apply Fuller semi-automatic ROADRANGER Transmissions to your operation. Ask your truck dealer now for full details on

the easiest-shifting transmissions available for your fleet. Specify Fuller ROADRANGER Transmissions for faster trip time, lower fuel consumption longer engine life, less driver fatigue and greater profits. Fuller Manufacturing Company (Transmission Division), Kalamazoo, Michigan.



Autocar Tractor with NH Cummins diesel engine and Fuller 10-speed R-96 ROADRANGER Transmission—ready to roll for Navajo.



Sketch showing principal dimensions and configuration of the reverse cone. This part is produced from seamless steel tubing.

## Many Unique Operations

## on the TurboGlide Transmission

### PART III

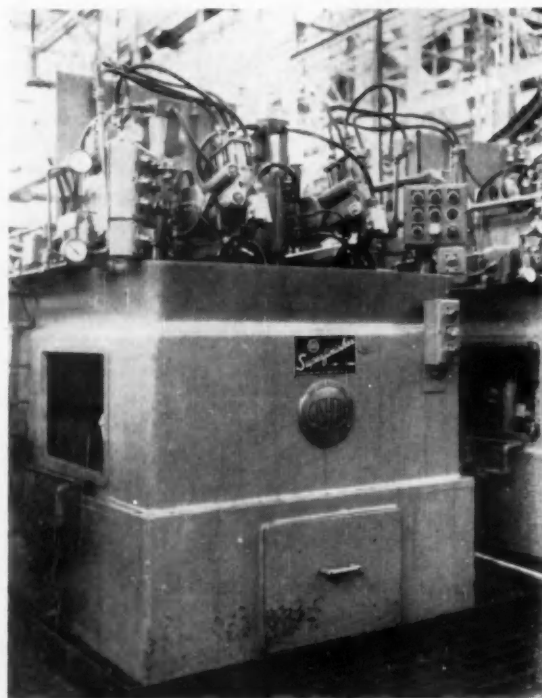
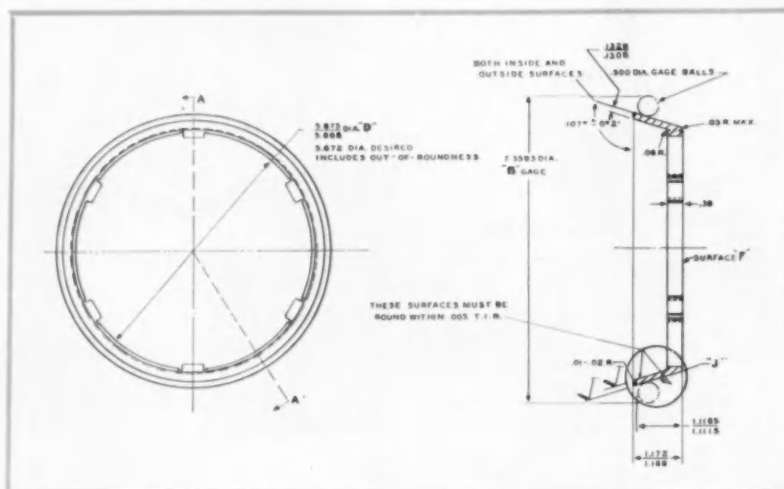
By  
Joseph Geschelin

**B**ESIDES its distinctiveness in using a large number of die-cast aluminum parts, and seamless steel tubing for shafting and parts that are usually made of forgings, the Chevrolet TurboGlide also features a number of unique "firsts" in component design and production techniques. This article is Part III on the manufacturing facilities in Toledo and is concerned primarily with some interesting individual operations.

The transmission reverse cone is an example of a part produced from steel tubing, using C-1141 seamless steel tubing, 6.688 in. OD by 5.138 in. ID. Preliminary blanking is done in a 7 $\frac{3}{4}$  in. four-spindle National Acme-Gridley screw machine which rough-turns the angular OD and ID, bores, and cuts off.

The reverse cone is so flexible as to be readily distorted by practically every metal removal step. Consequently, the routing has been so arranged as to maintain roundness insofar as is possible; the final correction for concentricity and roundness is made in the Gleason quenching die, following heat treatment.

Upon emerging from the screw machines, the cone is ground on one side in a Mattison surface grinder to provide the first important location point. Using this face for locating, the ID and six driving lugs



Inner and outer cone surfaces of reverse cones are finished in this Gisholt Super-finisher.

are broached in one pass in a 25-ton, 54-in. stroke vertical Detroit broaching machine. Inside diameter is held to 5.675-5.668 in. while the inner diameter of the lugs is held to 5.4174 plus or minus 0.002 in.

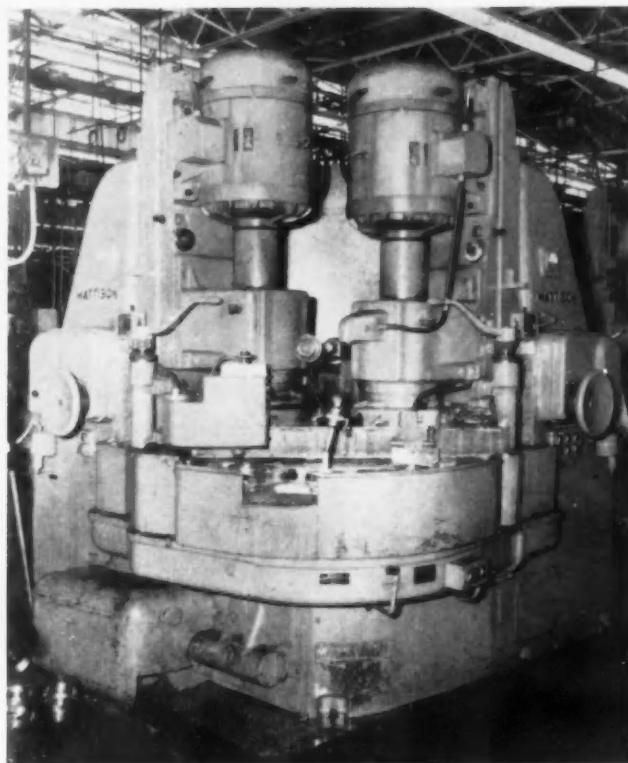
Semi-finish-turning of the angular ID and OD and facing are done in Ex-Cell-O 312 machines.

After it is heat treated and drawn, the cone is die-quenched in Gleason machines to produce roundness and concentricity. It then goes to an Ex-Cell-O No. 312 precision-boring machine for finish-turning of ID and OD and facing. For this purpose it is held against the ground face and clamped on the ID. In this operation the cone surfaces are held to roundness within a total indicator reading of 0.005 in., while the thickness of the cone section is held to 0.1328-0.1308 in. Final major operation on the cone is the superfinishing of the inner and outer cone faces in Gisholt No. 54 Superfinishes to a surface finish of 5 microinch.

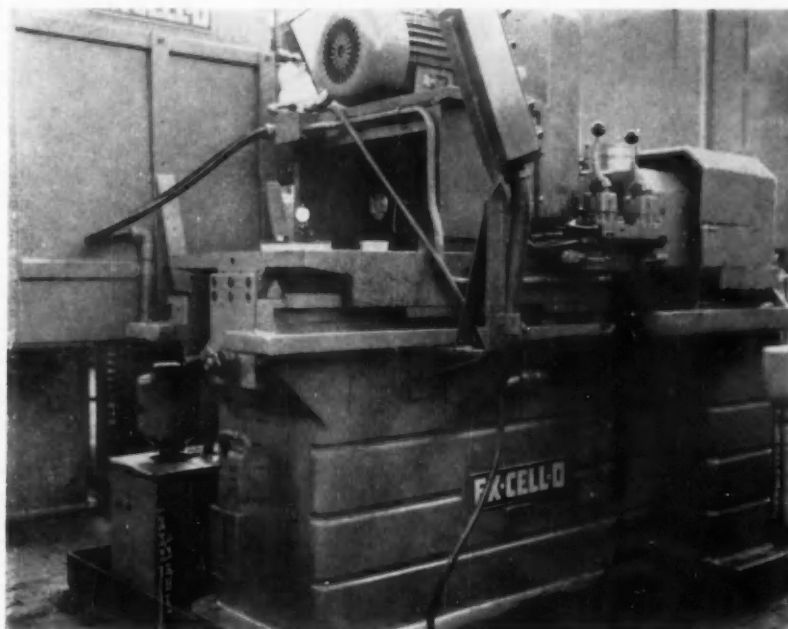
The Kingsbury multiple-head drilling machine has demonstrated its versatility in countless automotive applications. For this transmission, Chevrolet has succeeded in making Kingsbury machines do much more than is customary. The stator blade carrier furnishes an excellent example of the machine's adaptability. The blade carrier is composed of two pieces—the flanged hub and outer flange. The problem was to drill and ream dowel holes and fastening holes in both parts to produce an integral part. Instead of handling each part separately, as might be done conventionally, both parts are fitted together and handled as a unit.

The Kingsbury machine has been provided with a special head for feeding and pressing-in of the dowels; and another special head for feeding the five fastenings and driving them in place. To accomplish this the sequence of operations is as follows: drill and ream two dowel pin holes; press-in dowels; tap relief drill five holes through front carrier into rear carrier face; tap drill five holes through rear carrier; and finally put in place and drive five machine bolts.

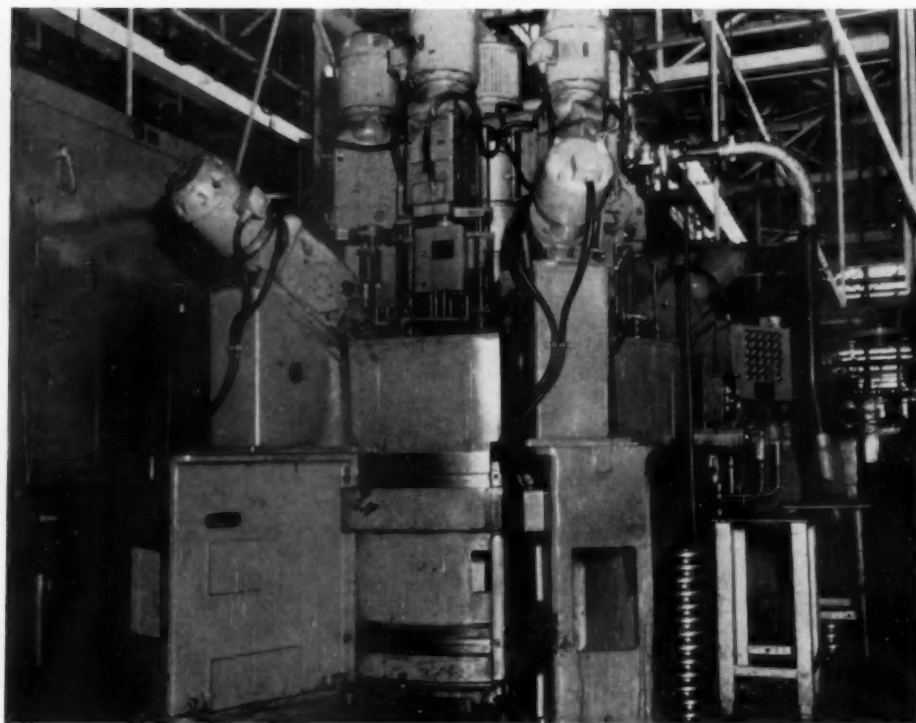
Another example of a unique Kingsbury application is found in the machining of the stator support. This part requires a large number of closely spaced holes in the face, together with a number of angular and horizontal holes. To handle these details within the fast cycle of the machine, without complicating the arrangement of heads, Chevrolet has developed an unusual approach. In addition to the main indexing table, each individual fixture is also made to in-



*The familiar Mattison surface grinder is set up for grinding the lug face of reverse cones.*



*A large battery of Ex-Cell-O precision boring machines is found in this plant. The one shown is used for turning the angular faces of the reverse cone.*



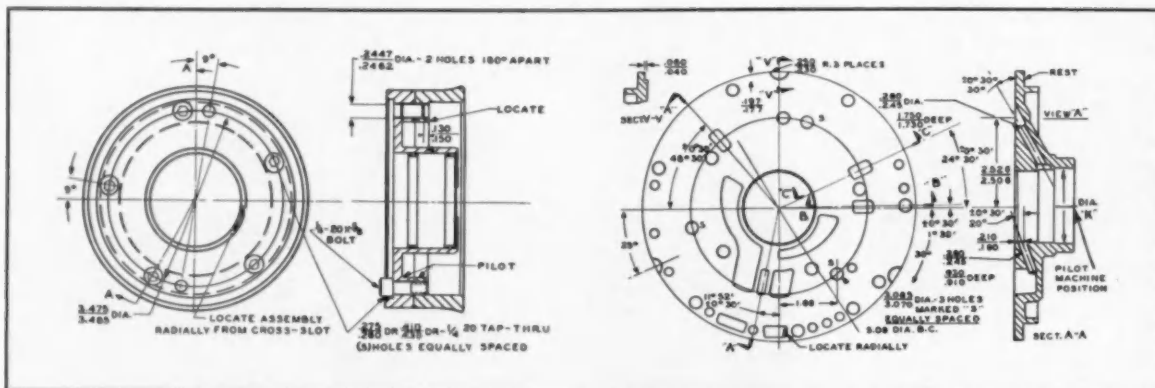
Here is one of the many special Kingsbury machines in use in this plant.

dex in a timed cycle effected by gearing from the center column. As a result the work rotates in the fixture so as to present the horizontal and angular holes to the front of the machine within easy reach of the heads. In addition, the angular location of the work is shifted so as to clear the spindles for the close spacing of holes.

One of the most distinctive operations, certainly a "first," is the eccentric boring of the cavity and both arcs of the lunar-shaped section of the front pump. Up to now, the practice has been to bore in two steps—one spindle for each center. Chevrolet, however,

has a special Heald precision-boring machine with only a single station. It consists of an inner and outer quill so mounted as to produce the eccentric boring cycle on two different centers. Each quill is driven independently from the rear of the machine and both rotate simultaneously. The important feature is that the angular relationship of the two quills is maintained in a carefully timed cycle by means of Gilmer cog-type belts. This timing enables the two boring heads to clear properly when operating on overlapping bores.

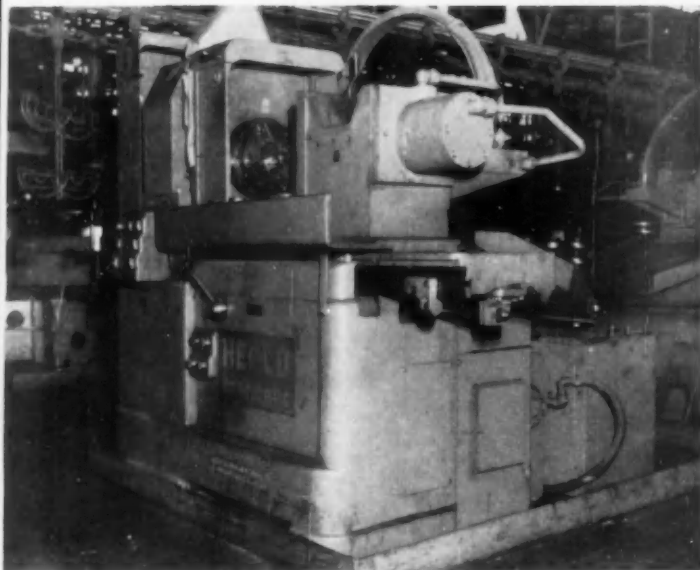
Although the quill mechanism and its drive are



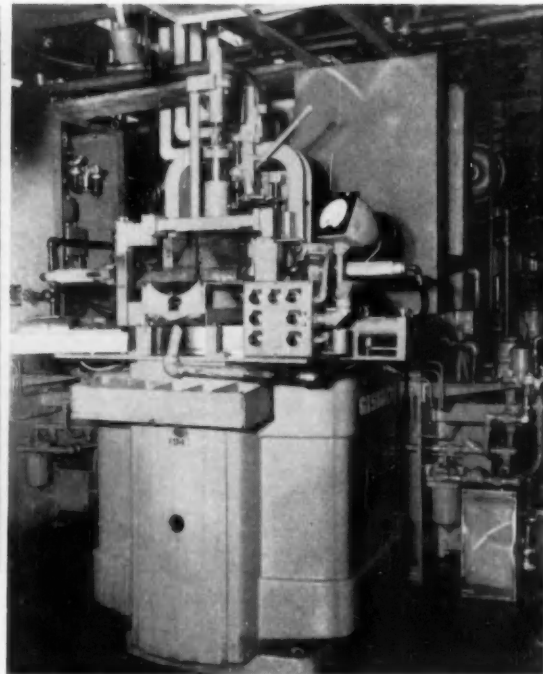
**A unique Kingsbury job is the stator support shown here. One of the problems in the machining of this part is the multiplicity of closely spaced holes**







**Close-up of Heald 221 Bore-Matic for the eccentric boring of front and rear pump bodies. The special boring head is exposed to view here.**



**Gisholt balancing machines of various types are employed for balancing components of the torque converter. This one handles the final balancing of the complete assembly.**

Double chucking imposes too many variables on this extremely critical job. On the other hand, when the entire job is done in a single setting there is no problem of maintaining the centers or the accuracy of the operation. Here is something that will merit the attention of everyone producing a pump of this type.

Since Chevrolet is the first to employ the triple turbine converter configuration it is of interest to look at the several aluminum turbine elements. The T-2 turbine, an aluminum die casting, is given preliminary machining, then the Armasteel hub is pressed in. Following this the element is subjected to additional machining to completion.

Initial operations are quite simple since the main job is done in a Hoern & Dilts (New Britain) vertical type, continuous precision boring and facing machine. It handles the following group of operations: precision-finish face both faces and groove the front side of the sun-hub; and bore the ID to receive the Armasteel hub.

The casting then is heated to 300 F for shrink-fitting of the hub. Pressing-in of the hub (which is serrated on its periphery) is handled in a Denison DG6-CO4 Multipress. This is followed by a staking operation in a Denison FG8-CO4 Multipress. Tooling of this machine is designed to circular-form-stake the lip of the sun-hub over the Armasteel hub OD chamfers, on the front face.

The assembly then goes to another Hoern & Dilts continuous boring and facing machine for the following operations: precision-face rear of vane shrouds and hub thrust face; turn inner vane shroud OD; bore and counterbore stator shroud ID's and press fit diameter for roller thrust washer in rear of hub.

This is followed by a Hoern & Dilts operation to precision finish-turn and groove the outer shroud OD,

face the front of vane shrouds and turbine hub, and turn thrust washer OD on the hub.

Balancing is the last major operation on the turbine assembly. All of the rotating elements of the converter have previously been balanced individually to a tolerance of 0.25 oz in. in a large battery of vertical-type Gisholt dynamic balancing machines. After the converter is assembled, converter fluid is added and the complete unit is balanced in Gisholt 1SV1 vertical balancing machines to the same tolerance as the individual components (0.25 oz in.). One feature of the Gisholt setup is the provision for injecting fluid for balancing, and for removing the fluid after the balancing operation has been completed.

Some impression of the complication of routing for individual turbine sub-assemblies may be gained from noting the steps required in producing the T-1 turbine assembly. Essentially it consists of the pressed steel shell, an Armasteel hub, the turbine section which is an aluminum die casting, and the T-1 shaft which was described in Part 2 of this series of articles.

The turbine hub is finished in a National Acme Model RPA 6-in., 8-spindle double-index chucking machine. The first chucking turns the front hub OD and face; and faces the front contour and flange face. The second chucking turns the OD face and rear flange face; and bore reams the hole.

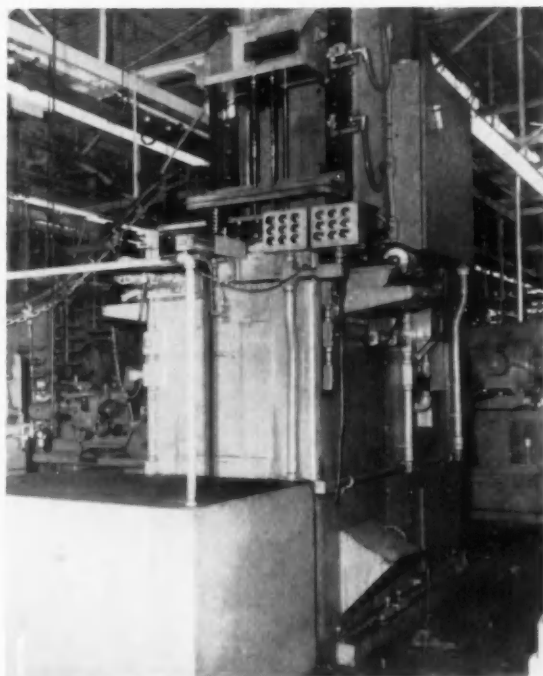
The internal 16-tooth spline then is broached in a LaPointe V-2, 10-ton, 42-in. stroke, two-station broaching machine. The spline has a DP of 18.83239, and a pressure angle of 20 deg. Maximum involute profile error and maximum cumulative pitch error are held to 0.0005 in.

The turbine shell, previously produced on one of the Verson Transmat presses, is processed in a Heald Model S vertical boring machine. Principal operations are—bore hub pilot diameter and face contact face. Six rivet holes then are drilled and chamfered on both sides.

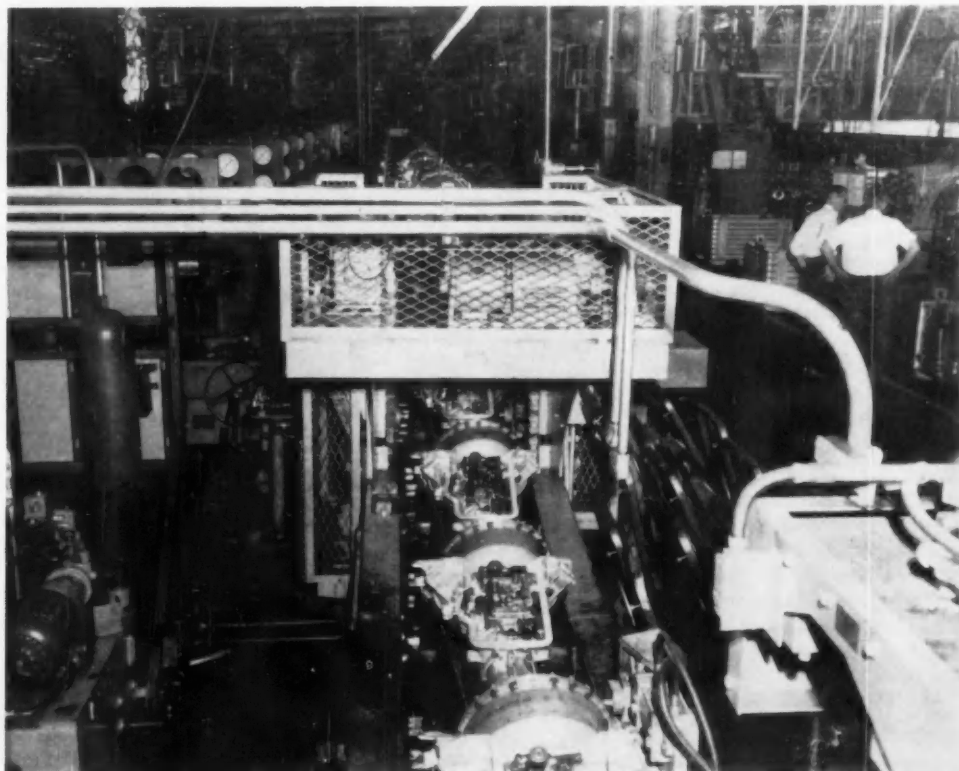
Meanwhile the shaft and hub assembly is prepared. To this end the hub is heated to 300 F and pressed onto the shaft in a Denison Model FG-8-ton Multi-press. The joint then is brazed in a special induction heater, using a brazing ring. Ex-Cell-O #112D single-end, two-station precision-boring machines perform the following groups of operations: finish-face flange and hub end, turn hub OD and shell-mating diameter; finish-bore bearing ID and thrust shell ID, face thrust face. Hub OD then is finish-ground in Cincinnati No. 2 chucking grinders.

The T-1 aluminum turbine element is machined completely in a Heald Model 352 vertical boring machine. It does the following operations: rough- and finish-turn the vane OD, work purpose ID and face. OD is held to 9.313-9.315 in.

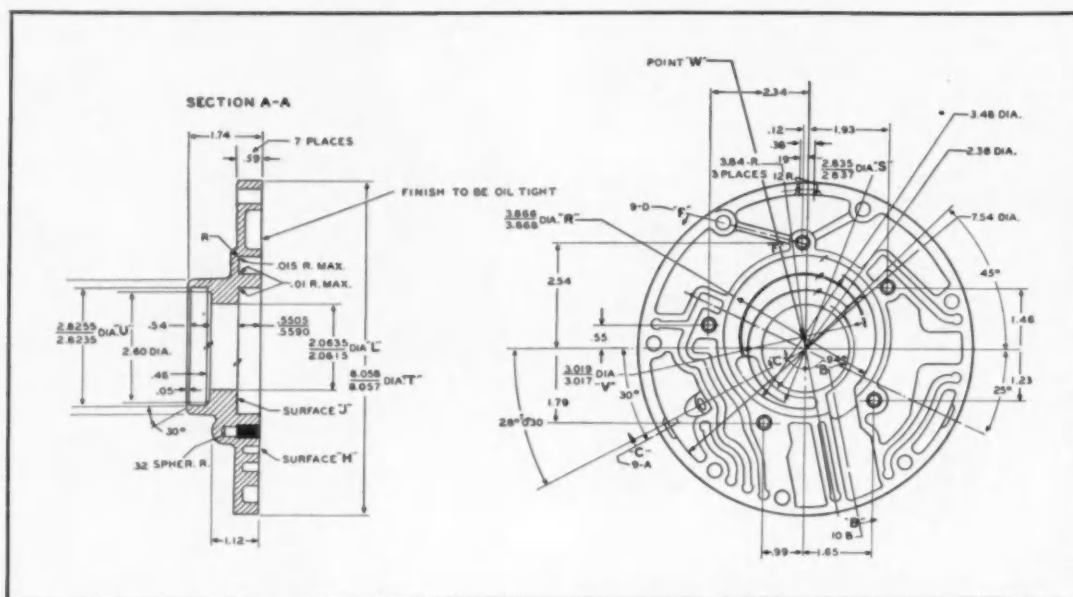
Final assembly of the T-1 turbine is as follows: First the shaft and hub assembly is riveted to the shell in a Denison press fitted with an automatic rivet feed. This is followed by the installation of the turbine element. For permanent attachment three "Roll-Pin"



Broaching of splines in the T-1 converter turbine hub is done in this vertical LaPointe broaching machine. The operator's position is on the platform in the foreground.



Perspective of the assembly conveyor which is seen traversing the final test stands in the background. In the foreground, tested transmissions are moving downward from the upper line of the conveyor system.



**Drawing of front pump housing showing the eccentric bores as well as the lunar segment which is finished on both arcs. Boring is done in the single-spindle setup in a Heald No. 221 Bore-Matic.**

holes are drilled through the turbine and shell in a special Leland-Gifford drill. Then the three Roll-Pins are pressed in place in a Denison hydraulic assembly machine. The ID is precision-bored and the clearance counterbored in a Heald Model 352 vertical, two-station boring machining. The entire assembly then is checked for balance and corrected as necessary, using a Gisholt 13-S Dynetric balancing machine.

Transmission assembly is concentrated in a large area of the plant and is centered about the power-driven assembly conveyor. The number of operators and stations along this conveyor line has been greatly reduced through the employment of individual sub-assembly lines. Most of the sub-assemblies and components are prepared and proof-tested on these individual lines, then transported to the final assembly line.

International conveyor systems are used both for the final assembly line and for the conveyor section that transports finished transmissions from assembly to the battery of some 14 test stands. The test area conveyor system is composed of two levels: The lower conveyor picks up assembled transmissions from the assembly line and transports them past the test stands, where they are removed by the operators. The upper conveyor, in turn, transports finish-tested transmissions to the end of the line, where they are picked off for shipment.

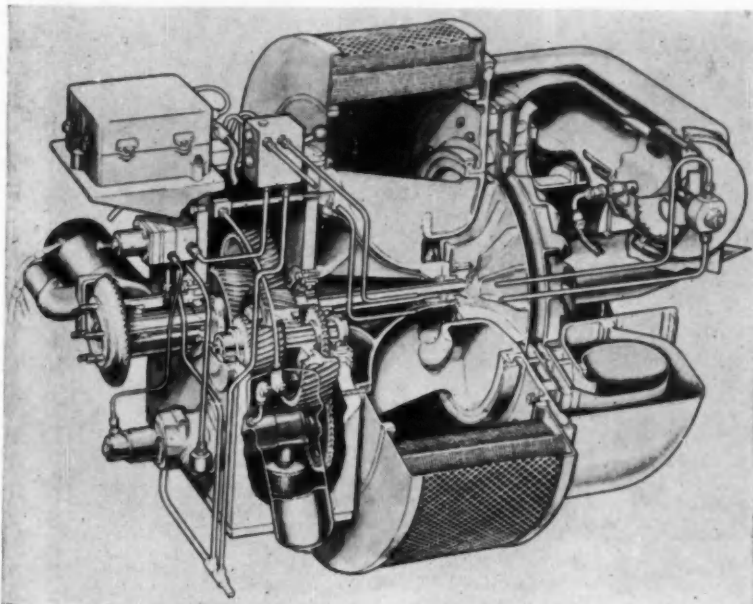
Incidentally, the upper conveyor section has an interesting automatic function. In the first place, when a transmission has gone through its paces on the

test stand, it is either acceptable or requires adjustment or disassembly. The only function of the operator is to accept or reject, depending upon the behavior of the unit on the test stand. In either case, just as soon as the test cycle has been completed the operator removes the transmission from the cradle and directs it to the upper conveyor.

Each pallet has a large guide pin (painted red) on the right hand front corner of the pallet. When the transmission is accepted the operator pushes this pin down. In the case of a reject, however, he raises the pin to top travel. As the transmissions reach the exit end of the conveyor the upper conveyor slopes downward to table height and at this point traverses a limit switch. Accepted units, with pins down, go right through to the gravity roller conveyor for shipment. The rejects, on the other hand, trips the limit switch. This stops conveyor movement momentarily, and permits a pusher arm from the side to push the unit onto a cross conveyor for routing to repair. At this point the pusher arm retracts, the limit switch returns to normal position, and movement of the conveyor is resumed.

With the publication of this installment we complete a very brief highspotting of selected features of the TurboGlide plant. Although the content of the three articles touches on only a sampling of this important facility, we hope there is enough to give our readers a picture of the variety of manufacturing problems and how skillfully many of them have been resolved.





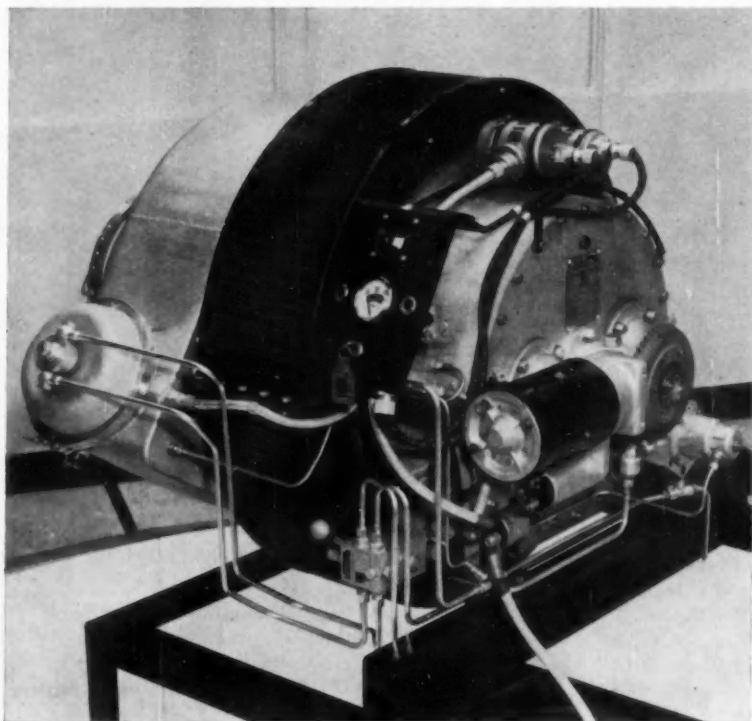
Cutaway view of the Standard 1S/250 gas turbine. Single-stage radial compressor and turbine are carried back-to-back on a common shaft. The inward-flow turbine at the right exhausts directly to atmosphere.

**A** NEW 250-hp industrial gas turbine introduced by Standard Motor Co. in England has a single-stage centrifugal compressor and centripetal turbine carried back-to-back on the main shaft. The annular induction area is enclosed by a large circular air filter. Running at 24,000 rpm, the 19-vane compressor has a 3 to 1 ratio and gives a mass flow of 5.2 lb/sec.

There are two combustion chambers parallel to each other and to the plane of the rotors. These are designed so that flame tubes, volutes and other hot parts are contained within the main air casing.

This is claimed to localize gas pressure loading; reduce distortion, weight and cost; and keep all external parts other than the exhaust pipe at temperatures below 250 deg C. Hot gases pass through a seven-vane

## Compact Gas Turbine Has Back-to-Back Rotors



diffuser to the inward-flow radial turbine with 17 vanes and a 14-vane nozzle ring.

Two-stage reduction gearing with twin countershaft provides optional ratios from 1 to 1 down to 16 to 1, giving a minimum output shaft speed of 1500 rpm. Gearing and drives from the oil and fuel pump are housed in a one-piece light alloy casting.

Normal starting is by a 12-volt motor of the heavy duty automotive type, and an ignition coil and spark plugs fire the atomized fuel. A non-electric starting system can also be supplied. Shaft speeds are maintained to within  $\pm 1$  per cent by a fuel-regulating governor.

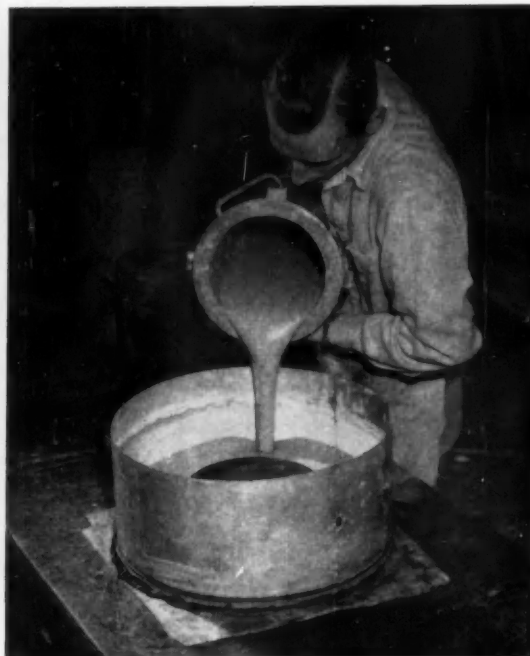
The entire unit weighs 350 lb and is 30½ in. long overall and 39 in. wide. While no heat exchanger is fitted, it is understood that Standard is developing an automotive gas turbine that will share a number of common parts with this basic engine.

Rear view of the Standard 1S/250 gas turbine, showing the reduction gear housing, starter motor and output flange. The fuel-regulating governor is at the lower right.





*Precoating the wax patterns for Mono-Shell molding*



*Pouring slurry in an Accra-Core setup*

# ADVANCEMENTS

*in the*

## Investment Casting Process

**By Kenneth Rose**

**S**EVERAL advancements in the investment casting process have been worked out by Misco Precision Castings Co., and are now in use at its plants in White Hall, Muskegon, and Detroit. They are broadening the size range possible with the process, or improving the quality of the castings obtained. These new variations in investment casting are the casting of the metals in a vacuum, the use of special cores to make possible larger castings, and use of ceramic shells for the molds to decrease the amount of material handled in the foundry and improve accuracy of the castings.

The basic process of investment casting is well



*Mold sections, ready for assembly*

understood. It consists of making wax patterns of the parts to be cast, surrounding these with a slurry or other investment of refractory material, drying the mold, melting out the wax pattern, and casting the parts in metal.

Vacuum metallurgy became an important adjunct to investment casting as the parts being cast for aircraft gas turbines began to include metals readily oxidized or highly absorptive of gases. Titanium and its alloys are especially difficult to keep free of gaseous contamination at high temperatures. Nickel and cobalt base alloys, with titanium and aluminum compositions, are being used in some of the newer high-thrust gas turbines. In the unit developed by a collaboration of Misco engineers and builders of vacuum equipment, metal is charged into a crucible through a system of vacuum interlocks and is melted by induction heating. Then the hot mold, taken to the equipment from the preheating oven, is positioned in the furnace compartment. Pouring can be done without breaking the vacuum in the furnace compartment, so that operations can be made continuous. In addition to the avoidance of oxidation or gas absorption by the metal during melting and pouring, the vacuum process prevents oxidation or thermal shock damage to the melting crucible.

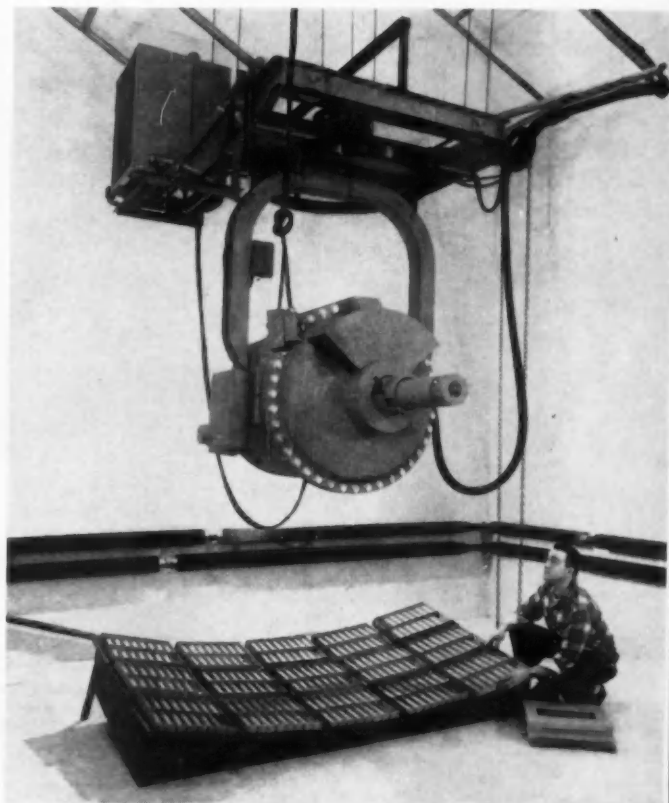
At the present time, the unit now in operation at Misco's plant is the only one of this design in existence. Operations are on an experimental or pilot plant basis, but have been so successful that an expansion of facilities is contemplated.

Another variation of the standard investment casting procedure uses a shell molding process in connection with wax patterns. The wax patterns, prepared in the usual way, are dipped repeatedly into a slurry of a refractory material, largely silica, and a thick layer of the refractory is built up over the pattern. The whole mass is then fired in an oven, which melts out the wax and at the same time strengthens the refractory shell so that it can be handled with tongs. In pouring, the shell is clamped over the top of one of the individual crucibles, which holds just enough metal for one mold, and when the metal reaches pouring temperature the furnace is inverted, the metal running from the crucible into the shell clamped over it.

The use of these ceramic shells for the casting of metal, rather than the much larger mold, saves material in the foundry, but more importantly, the more refractory silica shell permits the use of higher melting alloys. Because the shell is fired to a monolithic ceramic form, there is less dirt and slag to get into the metal. Heating cycles for melting out the wax and for preheating the mold are reduced because of the smaller amount of material to heat.

Misco is now set up to produce 350 molds per day by the shell process, and expects to expand production as the full possibilities of the process win recognition from industry.

Another process used at Misco stands between conventional foundry practice with sand and investment casting. It utilizes the refractory materials of investment casting, but with metal patterns or matchplate instead of wax patterns. A quick setting, high temperature ceramic cement is used to



*Placing pieces in order, several hundreds are X-rayed simultaneously*



*Wax is injected into pattern dies by automatic machines*

bond the investment materials as they are cast against the metal-pattern equipment. Mold sections are then dried in an oven, and afterward are assembled into a complete mold. This may consist of  
(Turn to page 117, please)

# Design Changes Less Costly with

**E**NGINEERING departments in the automotive industries are under considerable pressure to shorten the development time for a design—the time from drawing board to finalized design. Changes that must be made after tools have been prepared are troublesome and may be quite costly.

When the design involves cast parts, patterns must be made before a casting can be produced, and if the castings require cores, the coreboxes must be made also. In cases where the design has been finalized, and production equipment has been made, any changes will be costly and time-consuming.

Use of a system of patternmaking with epoxy resins facilitates the making of these changes in design in castings. The epoxies can be used for production equipment for both patterns and coreboxes. The same materials and techniques can be used for production of models, such as would be used for Kellering; to duplicate existing production pattern equipment; to construct new work, and to reface wood patterns that have become worn.

The epoxy resins find use in pattern and corebox work because of the property they have, in common with other casting resins, of changing from liquid, pourable state to solid state by polymerization. In a liquid state before cure, they can be poured into a mold, and will then change to a solid of the desired form. The mold, usually of plaster, is made from the wood prototype.

Advantages of the plastics pattern or corebox are in the simplicity with which the design is taken from the wood prototype to production pattern equipment, in the considerable saving in labor cost, and in ease of alteration. In addition to the saving in labor cost, the saving in time is large. It has been estimated that the plastics patterns and coreboxes are about 20 per cent lower in cost than machined metal equipment, when models and driers are required, and about 50 per cent of the cost of machined metal patterns and coreboxes when prototypes are used for the models.

The resin used in the work described is an epoxy material, and an amine catalyst is used with it. Resin and catalyst are mixed just before use, and in exact proportions. The mixture is of a soupy consistency, easily handled. A parting agent is required when the



Wood pattern for bearing cap is shown in center; to left is seen aluminum backup cast from wood pattern; to right, wood master model over which laminated molds are made



Assembling aluminum backups into molds

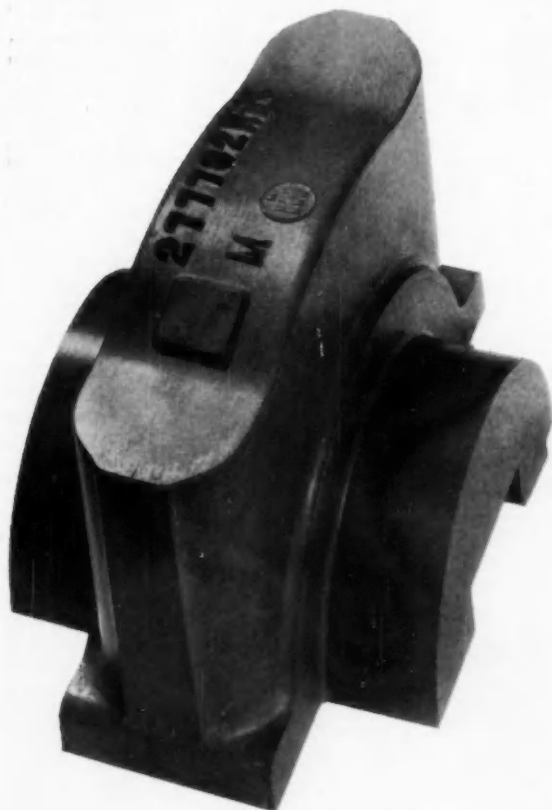
resin is applied to the plaster mold or wood prototype. Lacquer, wax, or a proprietary parting agent is applied. On green wood, aluminum paint is used. The material for the molds can be a low-shrink plaster, or

# Plastics Patterns

**By M. Ehrman**

Pattern Shop Supt.

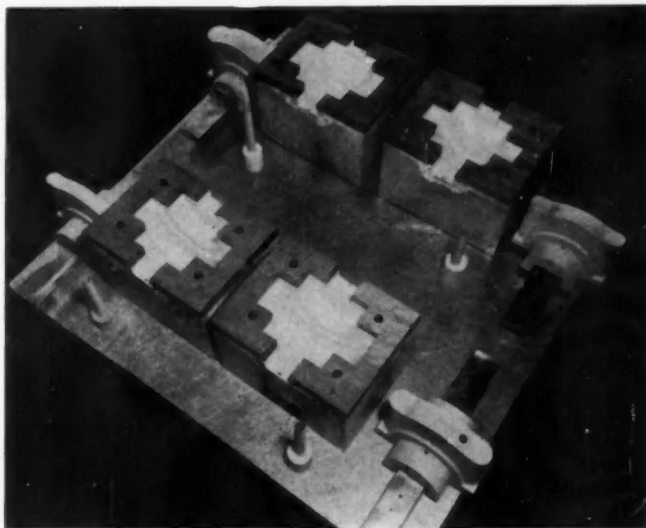
INTERNATIONAL HARVESTER CO.  
MILWAUKEE WORKS



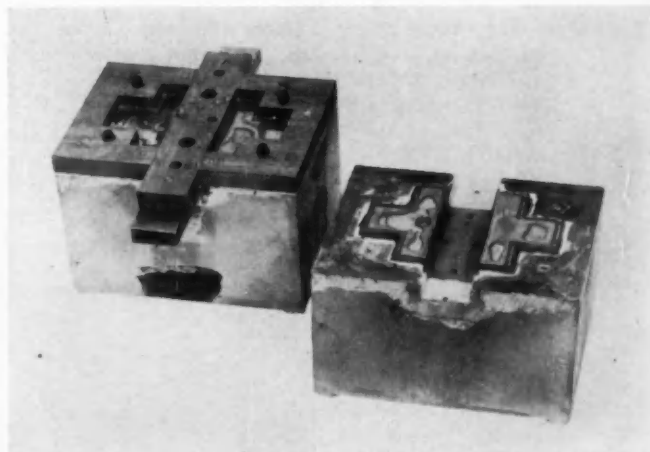
*The finished plastics pattern. Fifteen pieces are mounted on a pattern plate and cast in one flask*

may itself be a plastics laminate. The plastics laminate mold is more expensive than one made of plaster, but requires less sealer and produces a better job.

If a plastics pattern is to be made, starting from a wood prototype, the procedure is as follows: The prototype is coated with a parting agent, and a mold of low-shrink plaster is made around it. The plaster mold is then stripped off, the inside surfaces coated with a sealer, and the epoxy resin-catalyst mixture is poured into it. Cure begins at once, and proceeds for about 4 hr. During this time the mixture gives off heat, and the temperature may rise to as much



*Laminated plastic molds for four sizes of bearing caps are shown with aluminum backups outside of molds. On top of molds are wooden dams*



*Mold after resin has been poured is shown at left; wooden dams have been removed from mold at right*

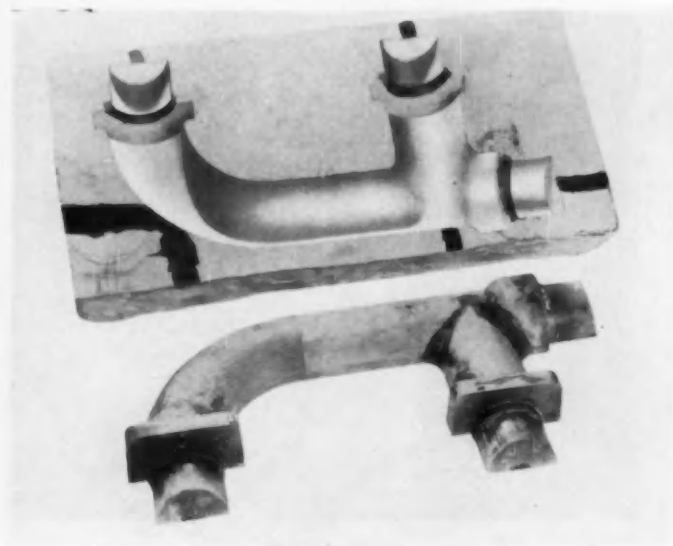
as 300 F. No outside heat is required for curing, however. The pattern is ready for inspection as soon as it cools.

The epoxy pattern can be machined without difficulty, as it contains no abrasive filler. Even when it is made by saturating glass cloth, the surface can be touched up easily.

For production patterns, it may be advisable to reinforce some portions of the piece with metal to withstand hard wear. The metal inserts can be positioned in the mold, and the resin cast around them; or, at times, they may be set in after the plastics pattern has been formed, depending upon the location and shape of the wear piece.

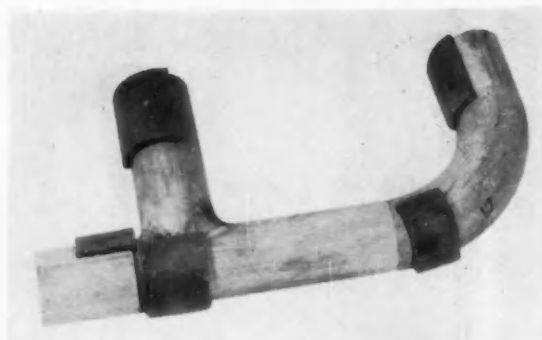
The procedure for making a corebox is somewhat more complicated. Here the object is to produce a box





**Master model and laminated mold for exhaust manifold front**

in which the working surfaces will be of plastics, and the back-up of aluminum. Provision must be made for venting the box when the cores are to be blown. The box starts with a parting board, on which is placed half of the wood core model, divided at the parting line. The core model is split along the parting line. The model, or plug, is then covered with modeling clay in a layer about  $\frac{1}{4}$  in. thick. After powder-



**Core stick is ready for construction of aluminum core-box backup. Small pieces of  $\frac{1}{4}$ -in. layer of clay are shown.**

ing over this first clay layer with a parting agent, a second layer of modeling clay is spread over it in a layer about  $\frac{3}{8}$  to  $\frac{1}{2}$  in. thick. A wooden box is then built about the whole, and the box is filled with plaster. The plaster covering is then removed, leaving the first layer of clay over the plug, and the second layer of clay is stripped off. The pieces are then reset, so that the plug is left on the parting board, covered with a  $\frac{1}{4}$ -in. layer of modeling clay, and between this and the outside box filled with plaster there is a  $\frac{3}{8}$ -in. void. This is now poured in soupy plaster. The plaster is allowed to set-up, then the mold



**Aluminum backup is set in place preparatory to pouring resin for pattern (right); piece at left shows aluminum backup in place**



is disassembled and wood ribs are added to the contoured plaster shell. This wood-ribbed plaster shell is then cast in aluminum. The aluminum casting is cleaned by blasting, and is then suspended over the original core model on the parting board, from which the first layer of modeling clay has now been removed. The  $\frac{1}{4}$ -in. void between the model and the aluminum backup is now filled with resin-catalyst mixture, and this bonds to the aluminum to form a corebox in which the face is a  $\frac{1}{4}$ -in. thick layer of epoxy plastics, with a cast aluminum backup box. The process is then repeated for the other half of the core model if the model has been split.

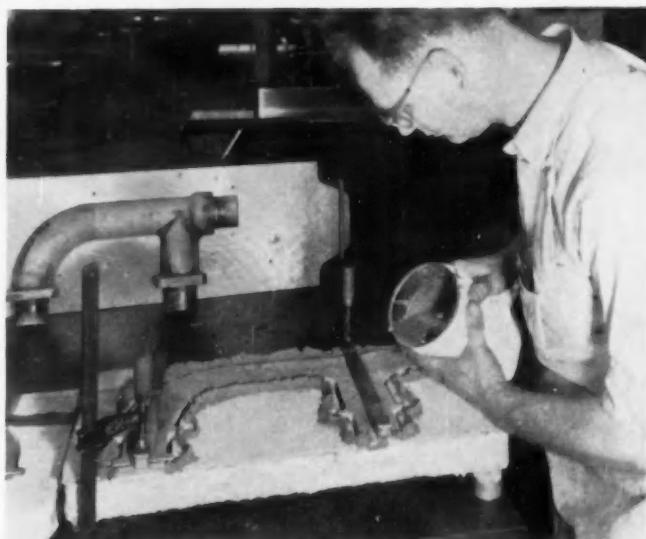
If changes must be made in the core, the plastics layer can be cut out without wrecking the aluminum backup, and, provided the changes do not exceed the  $\frac{1}{4}$ -in. thickness of the plastics layer, the backup can be suspended over the new core model and a new plastics layer poured.

As can be seen from the description of the process, use of the plastics pattern equipment makes it possible to go direct from prototype to production equipment. The surface in the casting resin is smooth enough and durable enough for hard service, thus saving the preparation and finishing of metal patterns for production after the wood patterns have been prepared for development. The amount of labor required is much reduced.

Just what these savings may be in dollars and cents is shown by the totaled estimates on 16 jobs. An estimate for conventional production pattern equipment for these jobs, given before the use of plastics patterns was begun, was \$44,455. The jobs were finally done in epoxy plastics, and the cost, including engineering changes, was \$20,836.

For the repair of existing patterns, epoxy plastics can make decided savings also. A drag pattern, in wood, for an oil pan had deteriorated beyond repair by ordinary means. It was estimated that replacement in metal would cost about \$2500, and would require three to four weeks. The worn pattern was relined with epoxy plastics, the resin bonding to the wood, and the original drag pattern was returned to service. The cost was only \$400, and the work was done in two weeks.

Pattern equipment can be duplicated in plastics also, and frequently at lower cost than in the case of metal patterns. A pattern for a power take-off housing, in cast iron, had to be duplicated to get required



*Pouring the resin between aluminum backup and plaster*

production. A bid for \$5255 for the second pattern in cast iron was received, and it was estimated that from 11 to 12 weeks would be required for completion. The pattern was finally duplicated in epoxy plastics at a cost of \$2800, and the work was completed in four weeks. A total of 702 castings have been made to date from the plastics pattern, and it shows no sign of wear.

Savings can be made also in production of new patterns. A set of cylinder head patterns, all in epoxy plastics, was made recently in about four months, at a cost of about \$30,000. A similar set produced about five years ago in metal cost approximately \$60,000, and required six months for completion.

While plastics patterns have many advantages, they should not be recommended indiscriminately for all pattern work. Where the pattern form is such that it can be finished in metal by turning or flat milling, metal patterns will have an advantage. Where the form is more intricate, patterns of epoxy plastics have a cost advantage, and also take considerably less time to complete. The most important advantage, however, is the considerable one of facilitating design changes, both during development and later.

### **GM Radio Isotope School Finishes 10-Week Session**

General Motors Corp. closed its first radio isotope school July 19 to wind up a 10-week session for six GM employees who learned the fundamentals and industrial applications of radioactivity. The trainees spent two weeks at GM Institute in Flint and eight weeks in the laboratory at

the Technical Center. They will assist their respective GM divisions in evaluating isotope applications.

### **Automobile Industry Planning Governors' Safety Conference**

Automobile manufacturers are planning to invite the governors of the 48 states to Detroit for a conference on highway safety. The two-day

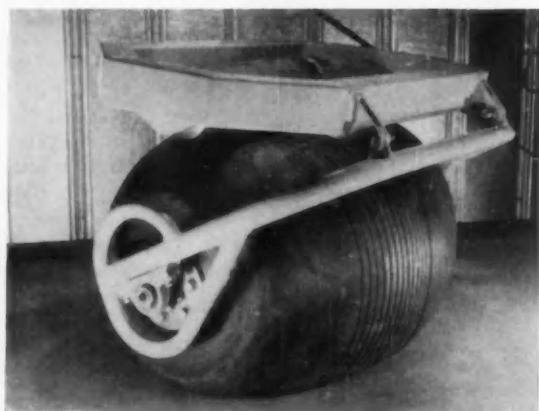
meeting will be held in late October.

An industry official sounded out the governors on the possibility of such a conference at their own 49th annual meeting last June in Virginia. The present plans have grown from his findings. The governors will discuss common problems and steps that might be taken toward greater highway safety through better enforcement, driver education, etc.



*The 7-ton Rolligon vehicle*

## New Tractor Uses Air Pillows for Wheels



The Rolligon's method of transport differs from the conventional wheel-tire vehicle's by carrying its load entirely upon the top surfaces of its ultra-low pressure air bags. Instead of the load weight being carried on an axle, it is placed upon a small, solid load roller, which revolves against the rubber bag's top. Both motive and braking power are applied to the rubber air bag through the little roller by friction contact.

**B**UILT specifically to operate off-the-road, the new Rolligon vehicle is able to carry a 7-ton payload cross country over rocks, swamp, brush, snow, and light timber deadfall. Its builders, the Albee Rolligon Co. of Monterey, Calif., expect it to be used extensively to open up and provide economical transportation for vast wilderness areas in many parts of the world.

Its spectacular performance is possible because of the extremely low air pressure of its air bags which press the ground at only two to three pounds when the truck is empty, and as low as five pounds fully loaded with seven tons.

The Rolligon's bags operate best when in a condition roughly the shape and feel of a semi-inflated air pillow. This way they are spreading their greatest contact area upon the ground for greatest distribution of the vehicle's weight and load. They are also in best form to "absorb" rocks and obstacles by "flowing around them"—providing a completely air-cushioned, shock-free ride.

The smaller 30 hp Albee Rolligon tricycle Diesel-tractor can be used as an agricultural machine, small

transporter for personnel, golf course and resort maintenance machine, power dolly and tug.

The softness of these air bags combined with the novel Rolligon method of rotating them, prevents destruction and scuffing of ground surfaces. As in the case of the 7-ton model, ultra-low pressure operation is an almost completely shock-free ride provided by the pudgy bags which automatically act as shock absorbers.



The smaller 30-hp Rolligon tractor has many of the 7-ton vehicle's features

## Bliss Demonstrates Overrun Barrier and Catapult

**E**W. BLISS CO. demonstrated last month at its Woodbine, N. J., test facility a barrier designed to stop an aircraft from overrunning a runway. Also used in the test was the first steam catapult designed specifically for land use.

### Overrun Barrier

Although the barrier was constructed for the Air National Guard, both the barrier and the catapult are expected to have far-reaching effects in commercial as well as military aviation. According to Bliss engineers, barriers

similar to the one tested could stop a commercial airliner without any discomfort to passengers.

In the demonstration, a test vehicle weighing 20,000 lb was hooked up to the catapult. It was then shot along the runway into the barrier cable, 40 ft from the catapult let-go point.

As the test vehicle, about the weight of a jet fighter, reaches the overrun barrier, it hooks the cable and carries it forward. Buried beneath the ground, and attached to the cable by a pulley arrangement, is the heart of the overrun barrier

—an energy absorbing engine (brake).

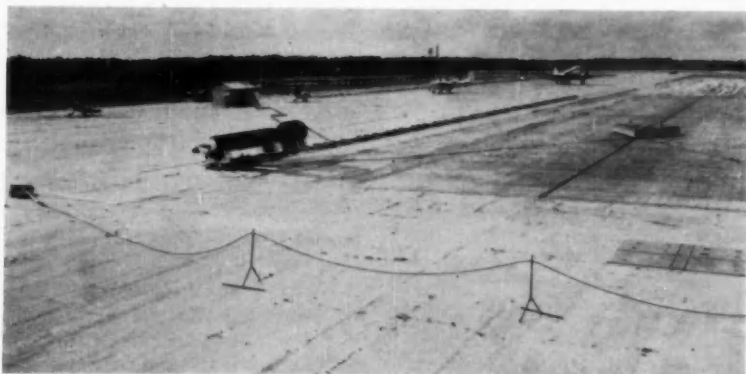
As a plane continues on past the point at which it was supposed to stop, a steady braking action is exerted on the cable, which plays out slower and slower until it brings the vehicle to a smooth stop. A self-adjusting controlling device regulates the amount of braking pressure exerted, so that a vehicle of a given weight, traveling at a given speed, is automatically brought to a smooth stop within a pre-specified run-out distance.

The barrier tested at Woodbine, for example, was built by Bliss to stop a 10-ton aircraft traveling at 150 mph in the distance of 400 ft. Other models can be built to accommodate planes of different weights, speeds, etc.

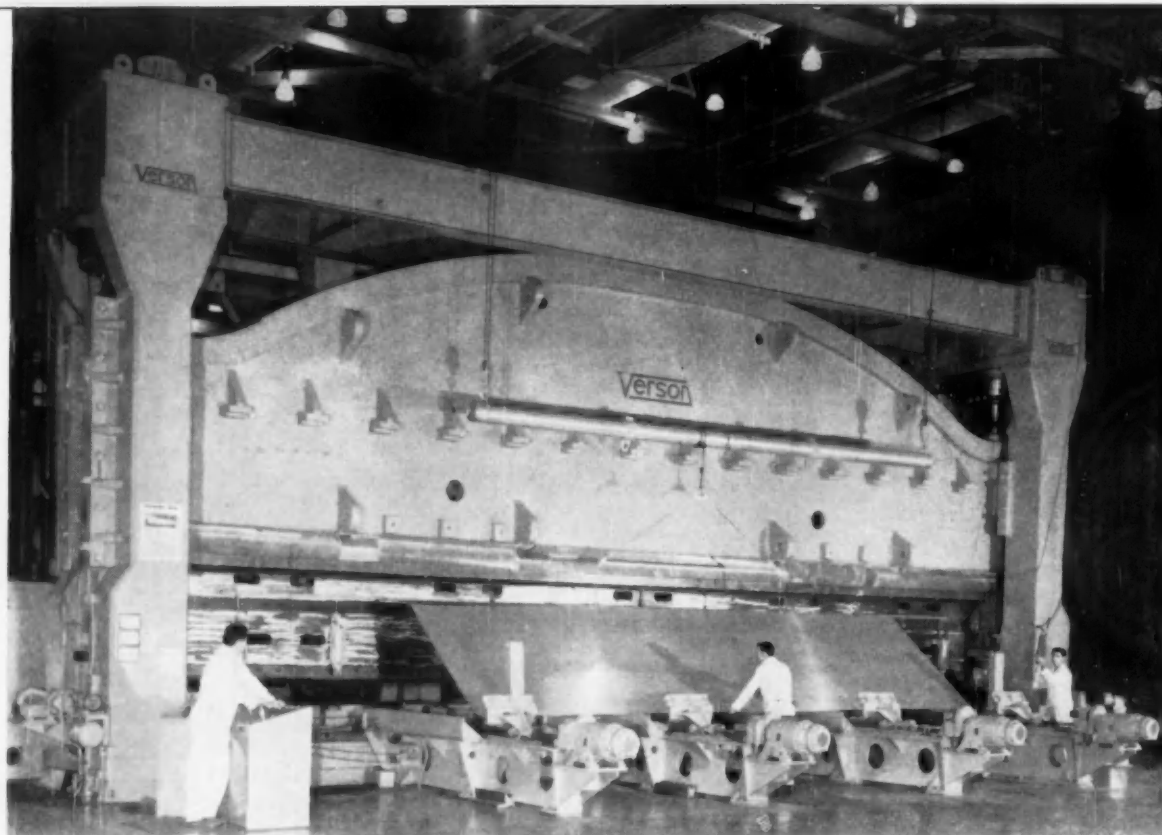
While in the Woodbine test the vehicle engaged a wire cable suspended across the runway, a special barrier webbing has been developed by the Navy and Air Force. This consists of nylon straps attached to the cable and running upward from it.

When the nose wheel strut of the plane hits the webbing, it pulls it out and flips up the lower cable just in time to contact the main landing gear. The latter, unlike the nose wheel, is strong enough to withstand the braking action of the barrier.

(Turn to page 155, please)



Ten-ton test vehicle is hooked to cable of steam catapult in preparation for launching. Catapult's steam accumulators and the long cylinder through which the steam drives a piston can be seen at left center. The building further to the left houses the 2000 psi generator.



Verson brake in operation

## The A3D Skywarrior on the Production Line

**W**HEN the El Segundo Division of the Douglas Aircraft company received a contract to manufacture the A3D Skywarrior, largest and most powerful carrier-based aircraft ever built, it faced problems which it had never encountered in 25 years of producing airplanes for the U.S. Navy.

This was primarily true because the assembly building at El Segundo was designed originally for the SBD Dauntless of World War II fame. Some idea of the complexity of the problems faced by manufacturing personnel can be gained by the fact that the horizontal stabilizer of the A3D has

**By J. L. Anderson**  
**A3D Project Superintendent**  
**Douglas El Segundo Div.**

almost half the area of the entire wing of the SBD.

Fitting this 70,000 lb twin-jet Skywarrior into assembly operations in the limited space available was the responsibility of tooling, planning, plant engineering, and assembly personnel.

Basically, the A3D has a high, swept-back wing, with its two J-57 Pratt & Whitney engines slung in pods underneath the wing. It is manned by a crew of three who

occupy positions in the forward fuselage section. Both wings and vertical stabilizer fold to facilitate carrier handling and storage in the hangar deck. The internal bomb bay is capable of carrying any weapon in the Navy's shipborne arsenal. Two automatically controlled 20 mm cannons are mounted in a tail turret for defensive armament.

The A3D has many unusual structural features which paid off in terms of performance but also introduced factors of producibility for tooling and manufacturing. Typical examples are the two keel members which run from the fuselage nose to the tail, forming the sides of the bomb bay and taking the loads of catapult and arresting gear.

When tooling was confronted with forming the contour of wing skins  $\frac{3}{4}$  in. by 76 in. by 310 in., extending from the intersection with the fuselage to the wing fold joint, they found there was no equipment available in the aircraft industry



**Side panels are combined with the landing gear**

which was considered suitable. To handle these big components it was decided to install the largest brake in the industry not only to form these skins, but also to do large forming jobs for other aircraft manufacturers. When the huge Verson brake was placed in operation, this particular problem was solved.

Tapered skins have been used for several years on load-carrying structures, such as the horizontal stabilizers, in order to reduce the cross sectional area from the center line outboard much more rapidly than dropping the gage of material in steps. On the A3D, tapering also is applied to the sheet metal spanwise stiffeners under the skins by using 200 in. tapered material formed into a "Z" section. This tapers in shape and reduces in bend radius in keeping with the thickness of the material while holding the overall height to 0.010 in. tolerance.

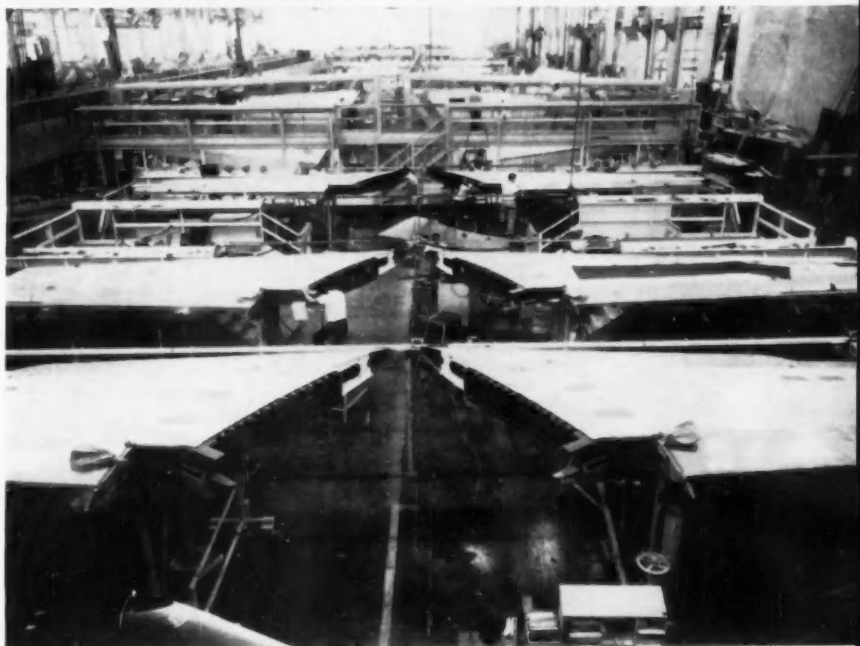
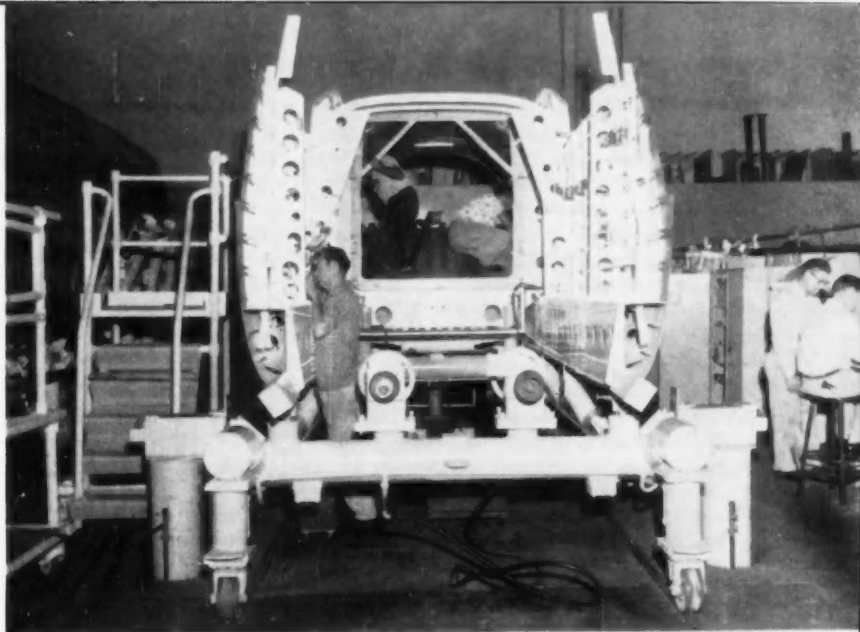
In conformity with division policy of subcontracting as much structure work as possible to small businesses, a large part of the structure work was turned over to six main contractors.

Due to the size of the A3D, which has a span of 72 ft 6 in., a length of 74 ft 5 in., and a height of 22 ft 9 in., as well as the space limitations in the assembly building, it was impossible to set up a line with airplanes placed nose to tail.

The only solution was to angle each aircraft and utilize movable work platforms. The A3D's large folding wings and folding vertical stabilizers meant that special "spotting positions" had to be utilized to fit the airplane into the production area.

With the advent of production, manufacturing personnel went from the stage of handling components manually to the use of lifting equipment, extensive use of work platforms, "double deck" assembly working areas, and the use of work platforms on hydraulic lifts to reach high areas.

The assembly line starts where the forward section from an outside supplier is unloaded from the truck directly on a seven station



**Completed tank assemblies are placed in a jig where wing leading and trailing edges are installed**

installation line. The heaviest concentration of installations goes into this portion of the fuselage and dictated the assembly lead time required.

Among the installations made at this point are the two engine bleed air driven turbine units which drive the ac and dc generators and hydraulic pumps. These units normally are mounted directly on the engine.

The heart of the complex

hydraulic and electrical systems stems from this section of the fuselage. The 5300 individual wires, which total 17 miles in length, are built into 354 major electrical assemblies. The largest wire harness, for example, weighs 90 lb and requires 155 man hours to fabricate.

Forward sections move down the line two abreast on wheeled dollies guided by a floor track. Mechanics work from the floor through access doors under the pilot's floor, with



permanent platforms overhead for access to the cockpit.

Fuselage side panels and keel box assemblies come in next where they are combined with the landing gear support structure forming an integral unit.

Next comes the aft fuselage section from an outside source.

From here the three major fuselage components move into the fuselage sew-up position where the fuselage assembly jig was designed with a line dolly as a part of the tool. By retracting four hydrau-

lically actuated index pins, the dolly rolls out with the fuselage ready for the eight station fuselage structure pickup and installation line. In this position, the installations are completed, including the main landing gear, except for installations that cannot be made prior to wing and fuselage mating.

Left and right hand inner wings are first assembled as a spar-to-spar box which form the integral wing fuel tanks. Each tank assembly is sealed, removed to a rotating fixture, and the inside sloshed with

a fuel sealant. Completed tank assemblies are then placed in a jig where the wing leading and trailing edges are installed.

It is interesting to note that the A3D was the first El Segundo Division airplane for the Navy to incorporate integral wing fuel tanks.

Because of the large size of the wing structures, they are joined to a center wing box in a vertical nosedown attitude to conserve floor space. The completed center wing assembly is removed by a sling and rotated to a horizontal position.

Cone shaped index fittings next are attached to the rear spar wing fold fittings at both ends of the wing. Then it is lifted in a horizontal position to the waiting fuselage in position on its dolly. The wing is lowered until the cone fittings index on ball fittings supported by floor posts. The fuselage on its dolly is raised until it engages the wing and is indexed by V blocks on hydraulic hoists.

The airplane now is transferred from the dolly that has carried it since it left the fuselage sew-up jig to a line dolly with hydraulic jacks. Two of these are located at the wing jack pads, and a third at the nose.

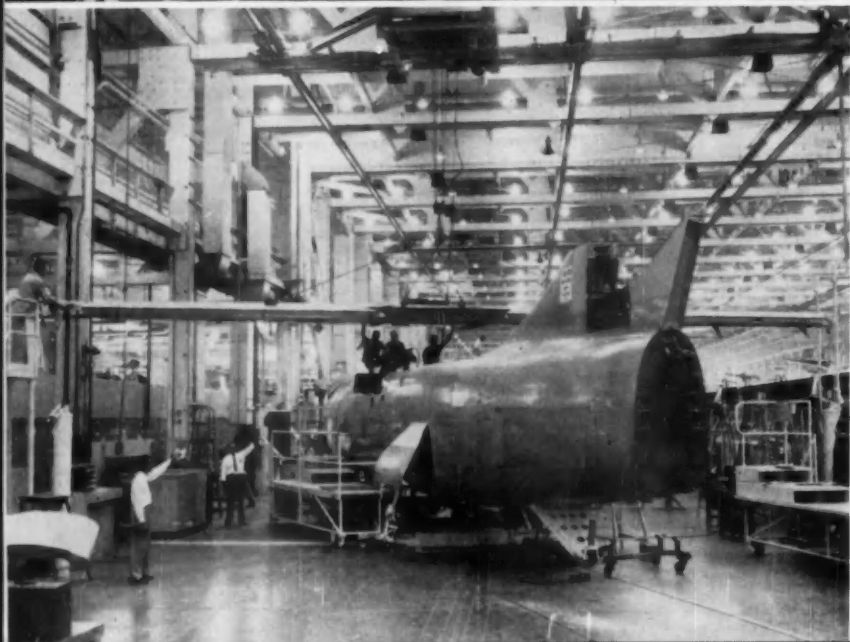
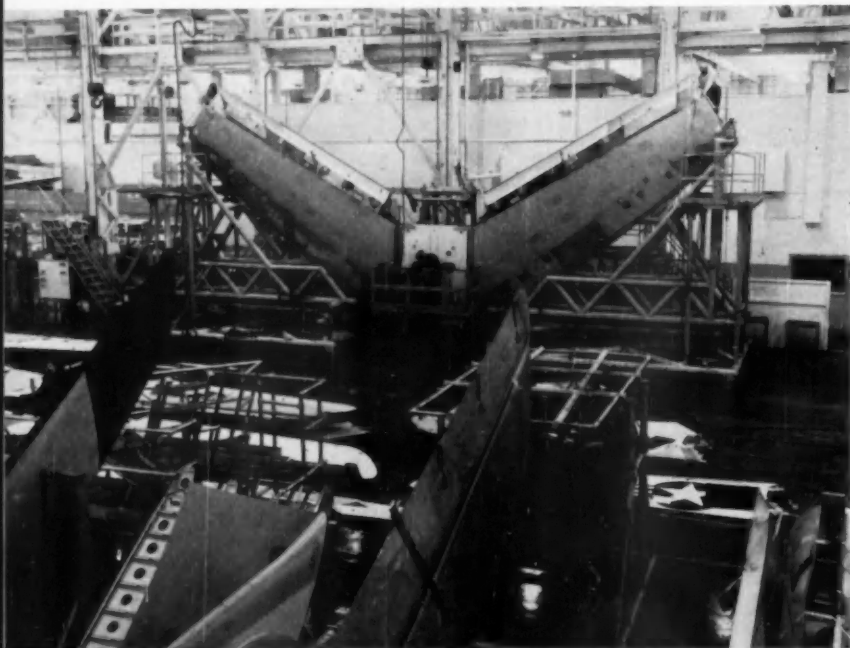
Two parallel lines of airplanes are necessary to provide an adequate number of positions for final assembly. In order to fully utilize available space, the airplanes are angled slightly, one line traveling nose first, the other line tail first. When the swept-back folding wing of an airplane on one line is extended, it falls between the wing and stabilizer of the neighboring line.

The first two of the 13 stations on the final line are used for completing miscellaneous wing attach structure work, installing the folding vertical fin and rudders, horizontal stabilizer, elevators, and the folding outer wings.

From here the airplane progresses down the line where the hydraulic systems are flushed, electrical continuity checked, and controls rigged. This is followed by preliminary operations, company and Navy inspection.

**Attaching wing to fuselage. Method of indexing is described in text**

**Wings are joined to a center wing box in a vertical position to conserve floor space**





Using a Denison hydraulic press to assemble piston rods of a compressor, to the wobble plate that actuates the rods. Ball ends are locked into spherical seats by closing in bushings under six-ton pressure.

## Ball Cups Assembled in Fast Hydraulic Press

**A**IR conditioning systems for passenger cars are being turned out in increasing quantities at one of the Frigidaire plants in Dayton, Ohio. Each of these assemblies includes a five-cylinder compressor whose pistons are reciprocated parallel to the axis of rotation by means of a wobble plate.

Each piston rod has a ground ball at the end that fits into a socket formed in the cast iron wobble plate. One assembly of five pistons and rods appears at the lower right of the accompanying illustration, which also shows a second assembly in process in a

fast eight-ton Denison hydraulic press illustrated.

Before these assemblies are made, the wobble plate undergoes machining operations that include the forming of five ball sockets equally spaced in a circle. Around each such socket there is also machined an annular recess into which a short sleeve or bushing is fastened. Its bore has a diameter slightly larger than that of the ball.

When the plate is ready for assembly to a piston rod (that has been fastened already into a piston) the rod is hand clamped in a split die with the ball in the axis of a spherical recess but at a fixed distance above this recess. Then the press operator sets the inverted plate so that the ball enters the bore of one of the bushings and against its spherical seat.

Thereupon, the press is tripped and a flat end punch carried by the press ram is lowered against the back face of the plate, which is up. As pressure is applied, the lower end of the bushing is forced downward into the die recess and is closed in or formed inwardly so that the metal of the bushing produces a socket or part of a spherical surface bearing against the ball. This, of course, permanently locks the ball inside the socket that is produced.

Although a fairly close fit around the ball is desired, the socket must not grip the ball so tightly as to bind, as this would not permit the piston rod to rock freely. It follows that the maximum pressure at the end of the press stroke must be such that proper forming occurs but that binding does not result. This pressure is six tons and is attained when the ram arrives at a certain fixed point.

When this point is reached, a closely adjusted microswitch is tripped by an arm that is fastened to the ram, with the result that a solenoid operated valve is actuated and immediately reverses the ram. Such release of pressure at the instant that the ram reaches a set point is easily accomplished in the Denison hydraulic press and is one factor that makes it so useful in precise assembly work.

As soon as the ram retracts, which is almost instantly, the operator unlocks the die with a hand lever, releasing the piston rod and, after moving the next rod into position relocks the die, starting the next cycle. It requires five cycles to complete the assembly of five rods to the plate, yet the operator can complete about 400 assemblies per eight-hour shift. This is fast work when it is necessary for the operator to take each part from adjacent trays, put the parts in place, lock the die, trip the press five times, remove the assembly and place it in a tote box.

### Dagenite Battery Being Used On Several British Aircraft

A 24-volt dagenite battery with a capacity of 25 amp-hr, produced by Peto and Radford, Ltd., England, is being fitted as original equipment on the Viscount 800 series and Vanguard aircraft made by Vickers-Arm-

strongs (Aircraft), Ltd. It is also available for replacement on the Viscount 700 series.

Known as the 12-ECM. 13-VA, it is the first battery produced in Britain to have built-in ventilation. The cell vent plugs are not exposed, but vent into a compartment on top of the battery, which is connected to a pipe

leading through the outside skin of the aircraft. Due to the differential pressure when the aircraft is flying, air from the cabin blows through this compartment and exhausts the gases outside the aircraft.

The battery cells are assembled in molded containers of high-impact polystyrene.

# Automatic Production Line

*for*

## Ball Joint Assemblies

**Chrysler Makes Front Suspension Ball Joints for Its Entire Line of Cars on Machines of Latest Design**

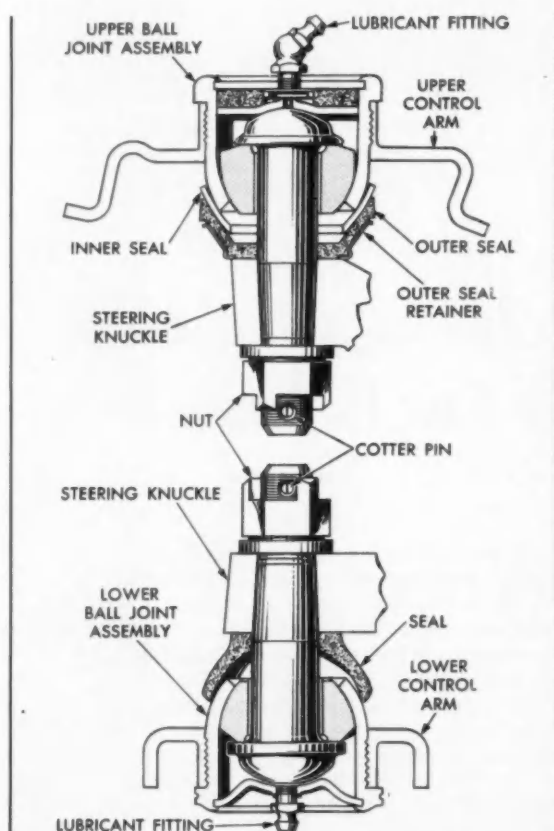
**By Kenneth Rose**

**W**ITH the Chrysler line of passenger cars switching to ball joint front suspension in its 1957 models, a production setup capable of supplying the needs of Imperials, Chryslers, DeSotos, Dodges and Plymouths for the units was a part of manufacturing plans. The facilities laid out in one of the oldest of the plants in the Chrysler Corp., the New Castle, Indiana, plant in which Maxwells were originally built, uses the most modern ideas in fabricating and conveyorizing to make the units in an automatic production line.

Two sizes of the suspension units are used in the Chrysler line, and there are two designs, for upper and lower assemblies, in each size. This means the production of four different ball joint assemblies in all. As all are similar, though not identical, a description of the manufacture of one is representative of the manufacture of all.

The ball joint assembly consists of a ball stud, a rocker, and a housing, with several smaller pieces, such as the pressure plate, pressure disk, cover plate and lubricant fitting. The important parts fabricated at the New Castle plant are the ball stud and the housing.

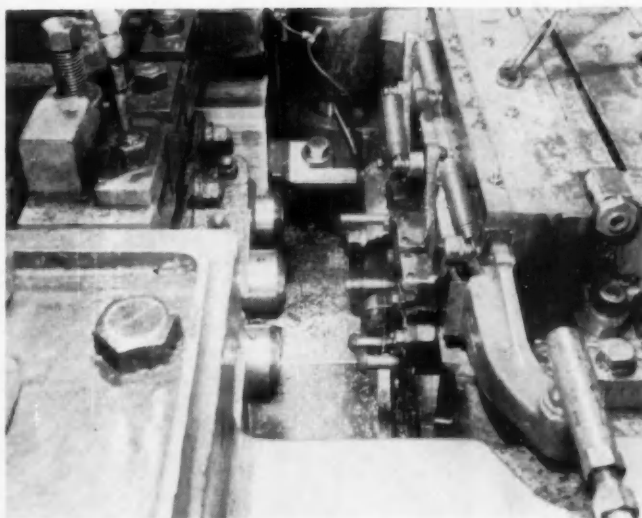
For the ball stud, a C 1040 steel is used. Several diameters are used for the four units, all nearly  $\frac{3}{4}$  in. in diameter. The round stock is purchased in coils, phosphate coated, ready for drawing. It is fed from the coil into a National Machinery cold header, where in three steps it is upset, headed, and cut off. It then goes to a conveyor in the machine, and the end opposite the head is swaged down to thread size. In the next station in the machine a thread is rolled on the swaged end. The studs then leave the cold heading machine and go to a drill press, where a hole is drilled for a cotter pin at the threaded end of the stud. This completes the fabrication of the stud.



**Cutaway views of the upper and lower ball joint assemblies**

To develop a wear-resistant surface in the studs, they are carbonitrided, then quenched in oil before they are drawn back.

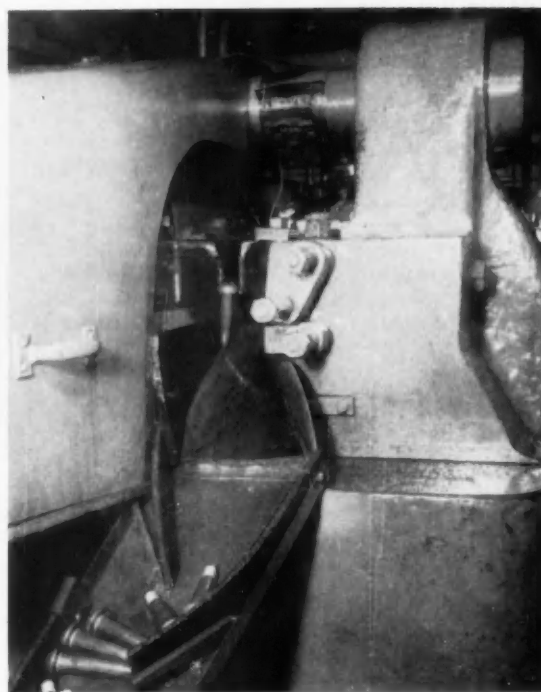
The housing is formed from a blank punched from mild steel strip. To get high production, the strip,



**The ball stud is formed from rod in a cold heading sequence**

about  $\frac{1}{4}$  in. thick, is fed into a Verson press which punches out three blanks at a stroke. The blanks are about  $3\frac{3}{8}$  in. in diameter, the exact size depending upon which assembly they are intended for. The disks fall from the press into a hopper, are picked up by a conveyor belt with diagonal slats and carried to a chute, and from there fed to a Mattison surface grinder where one side is ground to true it up. The blanks are then given a phosphate coating in preparation for the drawing operations.

For the first press forming operation, blanks are fed down a chute to the table of a Verson punch press, and are automatically positioned under the two punches that operate together. They are cupped to a



**Studs leave the cold heading machine complete except for one drilled hole and a heat treating operation**

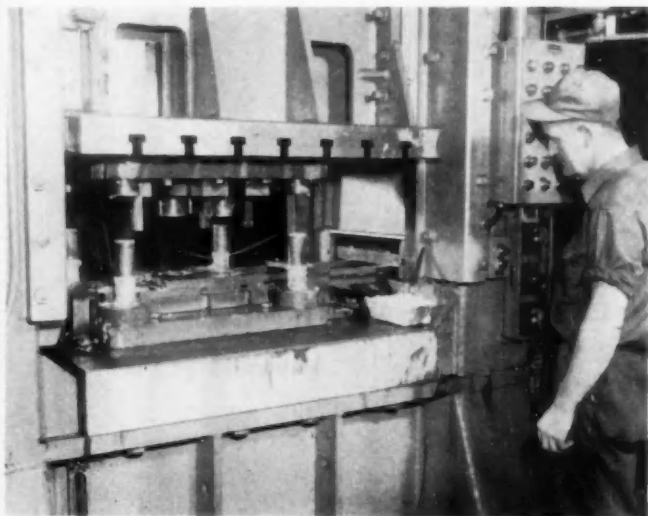
depth of  $1\frac{45}{64}$  in., outside measurement, in one punching. The cups fall from the press to a bucket type belt conveyor and are carried to a Mattison grinder, where the top of the cup is ground true to provide a working surface. They are then annealed in a continuous furnace and are rephosphated in a Detrex bath in preparation for additional press forming.

Cups are next extruded in a Verson press to increase the depth to 1.94 in. outside, and to form a shoulder at the top of the cup. The inside diameter at the top of the cup is enlarged by a punch. In the next press operation a hole is pierced through the bottom of the cup. The shoulder at the top of the cup is then trimmed to a square form with rounded corners in another Verson press, the cup is washed in a caustic solution to remove lubricant and phosphate coating, rinsed and dried.

The cups then travel on a conveyor to an automatic chucking machine, where a small radius is cut on the outside edge of the shoulder at the top of the cup, and a thread is rolled onto the outside of the body of the cup. The body is squared behind the shoulder also, so that the control arms to be attached later can be screwed up snugly against the shoulder of the housing. The housings are then washed to remove any lubricant, and are ready for heat treating.

Carbonitriding is in a continuous furnace. The darkened surface developed during heat treatment is retained on the housing.

The ball joint suspensions are assembled mechanically in a Denison Multipress. Assembly is com-

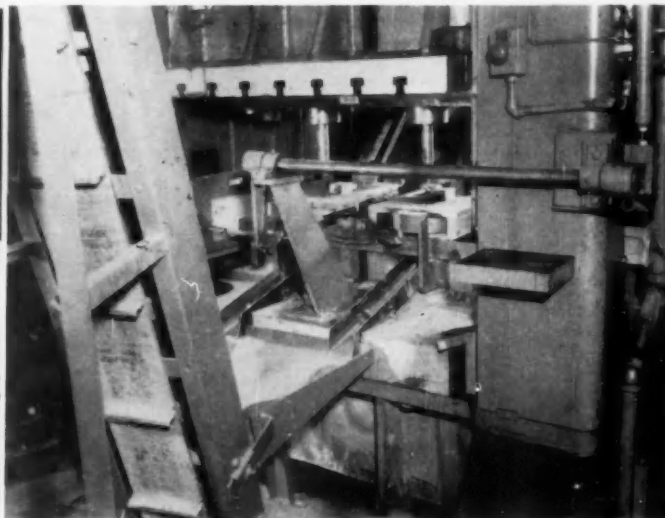


**An automatic side fed press blanks the housings from strip**





*The blanks are handled by interesting types of conveyors*



*Surface-ground disks are cupped in an automatic press*

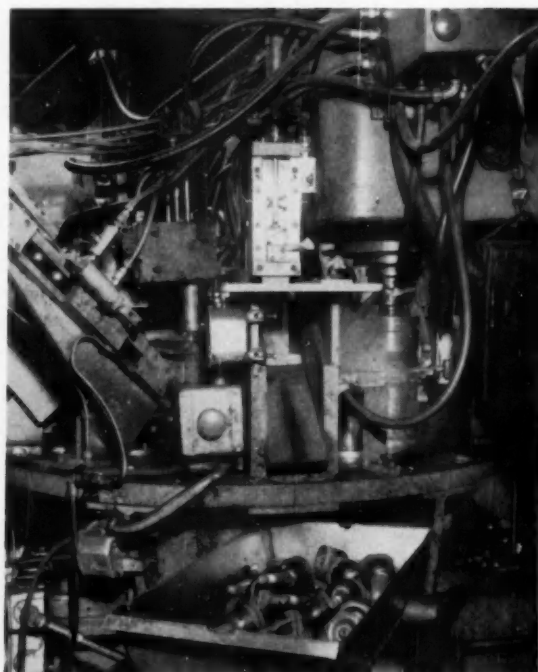
pletely automatic, with units fed from overhead magazines. This machine has 12 stations, though only 8 are in operation for this assembly. At the first station, the housing, or cup, is dropped into position on the rotating table of the machine. At the next station the rocker drops into position inside it. The ball stud slips through these two at the next operating station, then the pressure plate drops over the ball of the stud at the next operating station. The rubber pressure disk and the cover plate are added at the next two stations. At the next station the top edge of the cup is heated by the coil of a General Electric induction heater, and then immediately crimped over the cover plate by a stroke of the press ram. The top of the cup has been prepared for this by the work in the chucking machine, where the outside edge of the lip was cut away. The face of the punch in the crimping operation is flat, but the hot metal at the top edge of the cup is forced inward to seal the assembly permanently. Assemblies are then removed at the final operating station, the pick-off station, and travel down a chute to a tote box.

This completes the production of the ball joint suspension units, except for adding a threaded lubricant fitting to the cover plate. Later, upon assembly into the chassis, the control arm is screwed over the threads on the housing and the steering knuckles are attached to the shank of the ball stud.

In achieving automated production with these pieces, the conveyerizing is adapted to the handling of pieces sometimes awkward in size or shape. The steel disks that are pressed into housings are rather small in size, and must be fed to the grinder in flat position. They are picked up after being blanked from the strip by an inclined belt conveyor having slanted strips across its face to carry the disks. Scrapers remove any disk not properly positioned flat to the belt. The belt conveyor carries the disks

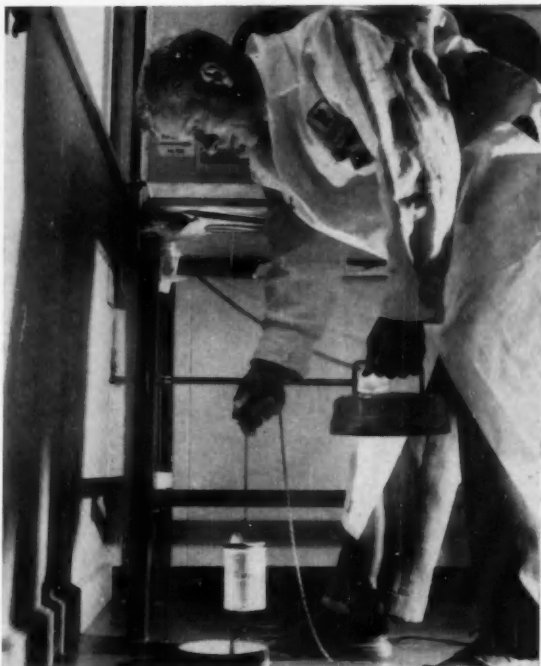
to the entrance to a gravity chute in which they slide off the slanted strips and into the chute while held in a vertical position.

In the magazines feeding to the Multipress performing automatic assembly, the pieces are positioned by their shape. Pneumatic or hydraulic controls release the parts one at a time, and the pieces, starting with the housing, are held in an assembly fixture.



*Assembly is completed automatically in a Multipress*





Radioactive material is stored in a laboratory floor vault at the new school.



The radiation field surrounding a heavily shielded Cobalt-60 radiation source is checked for possible radiation leaks.

## The General Motors School for Radioactivity

**G**ENERAL Motors has its own school for training men in radioisotope handling. Believed to be the first privately administered school of this type, it presents an intensive 10-week course. In the first class this summer are five engineers and one physicist from GM's Allison, Buick, Chevrolet, Central Foundry, Electro-Motive and GMC Truck & Coach Divisions.

The trainees start with a two-week lecture and laboratory series at GM Institute (Flint, Mich.), where they receive basic physics and fundamentals of radioactivity. Then they shift to GM Technical Center (Warren, Mich.) for eight weeks of lectures, experiments and safety instructions at the Isotope Laboratory, one of the largest private facilities of its kind, operated by GM Research Staff's Physics & Instrumentation Department. The students also make a short field trip to Oak Ridge, Tenn., to see the Atomic Energy Commission's original graphite reactor in action, producing many of the isotopes used in their experiments.

The GM Isotope Laboratory faculty owes its basic education in handling "hot" materials to AEC. In 1953 GM Research Staff began assigning specialists to Oak Ridge classes and later several AEC-trained men joined the laboratory organization. These men are primarily engaged in radioisotope research.

The underlying motive of GM's new school is to

overcome a shortage of trained personnel. Use of radioactive materials has opened to industry unlim-

*(Turn to page 122, please)*



In foreground, radioactive counting sample is being inserted in a lead shield pig while trainee in background handles radioactive materials in a Berkeley box with built-in rubber gloves and sleeves.

# Automated Blasting Unit

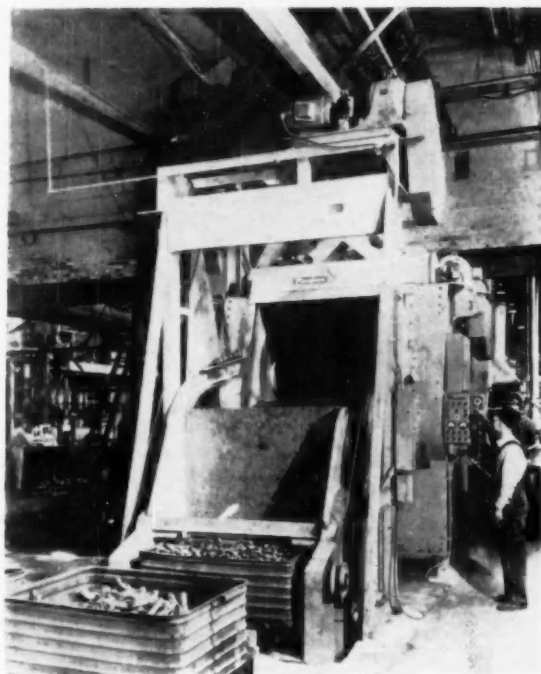
## *Reduces* Cleaning Costs

**A** FULLY automatic cleaning cycle and new automated loading device of an extra large Rotoblast unit are reducing cleaning costs and material handling time at the Atlas Drop Forge Co., Lansing, Mich. Intricate alloy, stainless and carbon steel, and titanium forgings from ½ lb to 300 lb each are cleaned twice as fast while material handling time is down by 60 per cent.

The company formerly utilized a separate monorail blast room, a 17½ cu ft batch barrel and an 8 ft Rotoblast table to clean its forgings for the automotive and aircraft industries. Now, a 27 cu ft Pangborn Blastmaster barrel with special automated loading unit is cleaning the major portion of the work load previously handled by three separate machines. The large size of the new installation also allows barrel cleaning of large forgings previously handled only by the monorail room.

This special loading device has three stations, two of which precede the loader in the work flow plan. The fork truck operator places a fully loaded large tote box of forgings on an indexing track. When the machine is set in operation, the tote box moves into the work loading unit and the operator places another full tote box in the first position. As the tote box of forging advances to the loading unit it is seized firmly, picked up by the loading device and elevated in such a position that it discharges its load in the work chamber of the large 27 ft barrel. The loader then returns to its normal position and the empty tote box is advanced through the loader mechanism to receive the cleaned load of forgings upon discharge from the barrel.

The fork truck operator, who also acts as the blast cleaning barrel operator, does three things: (1) removes tote boxes full of cleaned forgings after discharge from the barrel, (2) operates the signal panel



*With two loads of castings in position, the fork truck operator sets the cleaning cycle in operation. Operator also loads tote boxes of forgings to be cleaned onto the indexing track and removes boxes of clean forgings.*

for continuation of the automatic blasting cycle and (3) keeps moving tote boxes of forgings to be cleaned on the loading ramp.

Complete cleaning coverage in this large barrel is facilitated with two Rotoblast wheels instead of one found in other blast cleaning barrels. Despite the larger abrasive handling capacity, abrasive costs have been cut to a minimum with an abrasive tight door construction and a secondary automatic feature of the barrel that provides tumbling of the castings after blasting cycle to remove abrasive from deep pockets and prevent excessive carry-out.

### **Detroit Police Begin Drive Against Heavy Exhaust Smoke**

The Detroit Police Dept. has launched a drive against excessive motor vehicle exhaust smoke. It is using as a basis for the campaign a color movie and a pocket guide pre-

pared by the Automobile Manufacturers Association.

AMA developed the materials to aid police in recognizing excessive exhaust conditions and also in spotting normal or unavoidable emissions. The guide, carried by police officers, contains color illustrations of typical

excessive exhaust from an automobile, gasoline truck, gasoline bus, Diesel bus, and Diesel truck with both horizontal and vertical exhaust.

Several other cities, including Los Angeles, Cincinnati and Pittsburgh, are expected to adopt the primarily educational program.



**What  
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is a  
quality  
fastener?**

Here is a handful of ELASTIC STOP® nuts. Each has ESNA's familiar red locking collar . . . is self-locking and vibration-proof. Each is a readily assembled, one-piece unit. Each provides positive protection against thread corrosion . . . prevents liquid seepage along bolts. Each is made from the finest of raw materials. Each is exactly controlled as to finished dimensions, class of thread fit and finish. Each is now in use on critical applications, with a record for uniform high quality that is unmatched.

*Most of them are standard parts. Some originated as the result of a specific request for ESNA's help with an important fastening problem.*

Isn't it logical to call on us with your next fastening problem?

## ELASTIC STOP NUT CORPORATION OF AMERICA



Elastic Stop Nut Corporation of America  
Dept. N62-95, 2330 Yauxhall Road, Union, N. J.

Please send the following free fastening information

☐ ELASTIC STOP nut bulletin

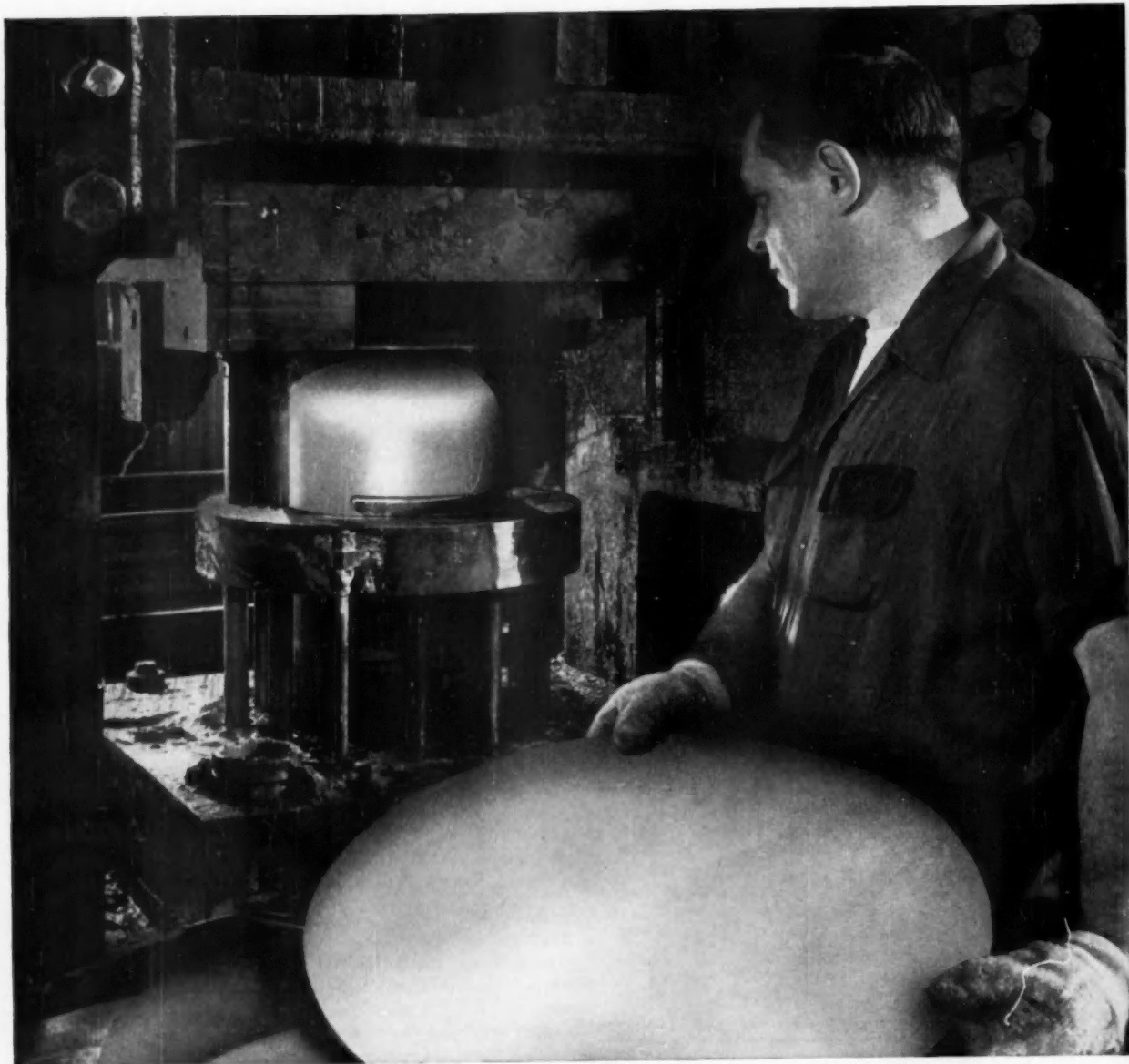
☐ Here is a drawing of our product.  
What self-locking fastener would  
you suggest?

Name \_\_\_\_\_ Title \_\_\_\_\_

Firm \_\_\_\_\_

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City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_



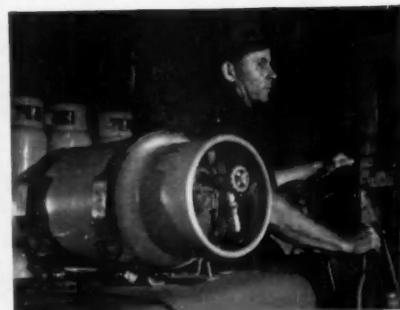
Here N-A-X FINEGRAIN steel proves its versatility, forming readily under the deep-drawing operation that pressure cylinder manufacturing requires. For 20-lb. cylinders, .086" N-A-X FINEGRAIN blanks, 21 1/4" in diameter, become 12" in diameter and 7 1/2" in depth after the drawing operation. Steel Cooperage Division produces cylinders up to 425-pound capacity.



Submerged arc welding operation joins the two cylinder sections together. N-A-X FINEGRAIN again demonstrates its weldability under any process.



Here cylinder pressure capacities are tested hydrostatically at 480 lbs. psi, after the fittings have been added. Final burst pressure—1650 lbs. psi.



Finished product on the job. This cylinder, meeting all specifications of I.C.C. code, Section 4BA, contains liquefied petroleum for materials handling truck.

For whatever you make . . .

# N-A-X® FINEGRAIN STEEL

## BUILDS IN STRENGTH WITH LIGHT WEIGHT

A significant example of the strength, formability and weldability of N-A-X FINEGRAIN steel is to be found in the manufacture of liquefied petroleum gas cylinders by Steel Cooperage Division of the Serrick Corporation, Detroit.

These lightweight LP-Gas cylinders must be able to withstand high internal pressures. Therefore, the steel used in their manufacture must have a minimum yield strength of 50,000 pounds per square inch and a tensile strength of 70,000 pounds per square inch, in order to meet the requirements of Section 4BA of the I.C.C. specifications.

On this job, as with so many others, N-A-X FINEGRAIN steel resulted in lighter weight, without sacrifice of strength and safety.

**Check these important advantages for your job:** N-A-X FINEGRAIN steel, compared with carbon steel, is 50% stronger • has high fatigue life with great toughness • is stable against aging • has greater resistance to abrasion • is readily welded by any process • offers greater paint adhesion • polishes to a high luster at minimum cost. And the physical properties of N-A-X FINEGRAIN are inherent in the "as rolled" condition. N-A-X FINEGRAIN's resistance to normal atmospheric corrosion is twice that of carbon structural steel. NOTE: Where greater resistance to extreme atmospheric corrosion is an important factor, our N-A-X HIGH-TENSILE is recommended.

For whatever you make, from pressure cylinders to tractors, with N-A-X HIGH-STRENGTH steels you can design longer life, and/or less weight, and economy, into your products. Let us show you how.



N-A-X Alloy Division, Dept. J-5

**GREAT LAKES STEEL CORPORATION**

Detroit 29, Michigan • Division of

**NATIONAL STEEL CORPORATION**

N-A-X Alloy Div., Dept. J-5

Great Lakes Steel Corp., Detroit 29, Michigan

- ☐ Please send me technical data on N-A-X FINEGRAIN steel.  
☐ Please have your representative contact me.

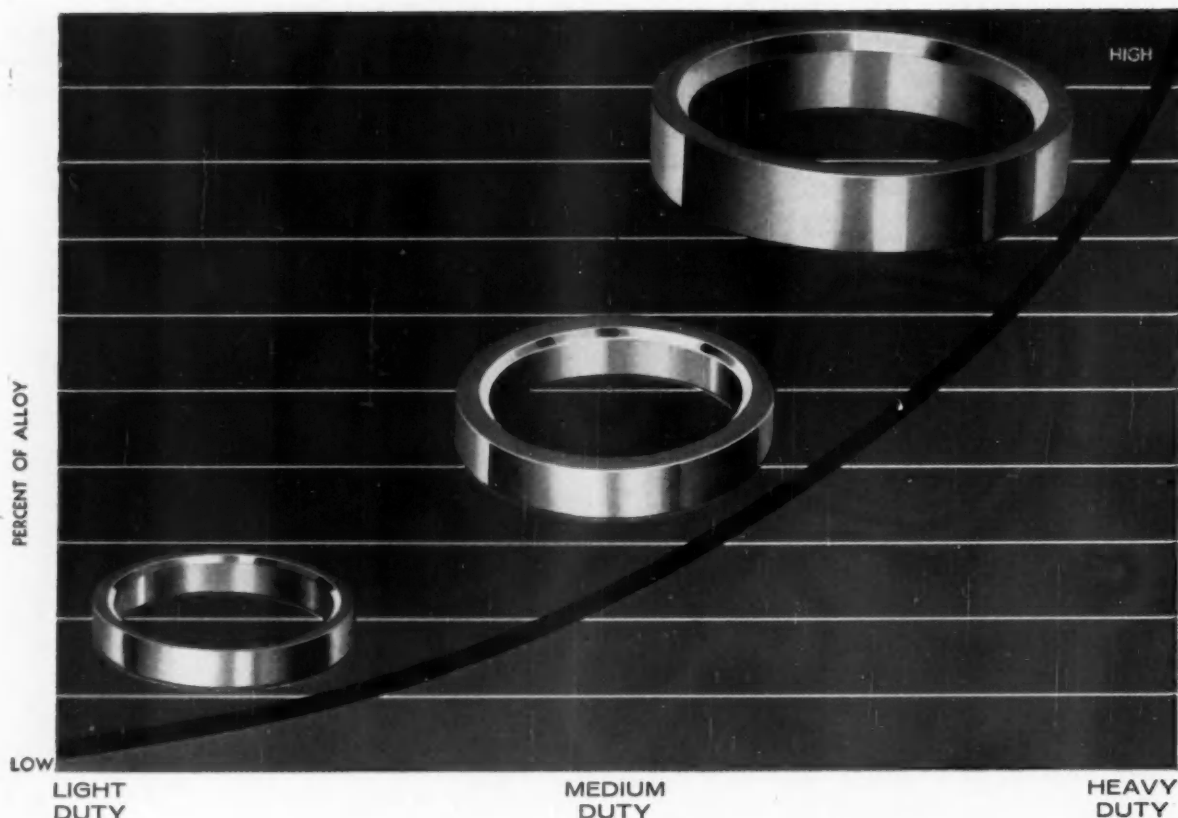
Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_





## **The RIGHT Insert for the Specific Application Is Always the Most Economical**

For heavy duty service involving extreme wear, corrosion, and oxidation, the highest performance high-alloy seat insert that can be produced is almost certain to be the most economical. On the other hand, for light duty service, a low cost insert of low alloy content may be adequate for the requirements. Eaton produces seat inserts "custom tailored" to meet the demands of each specific application — skillfully blends chromium, nickel, molybdenum, tungsten, cobalt, and iron to provide the right properties to overcome wear, corrosion, and oxidation. The result is inserts which will give optimum life at lowest cost, in the kind of service for which they are designed.

*Call our engineers for a consultation  
on your seat insert problems.*

# **EATON**

**SAGINAW DIVISION**  
**MANUFACTURING COMPANY**  
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*Pacific Coast: National Screw & Mfg. Co. of Cal., 3423 South Garfield Ave., Los Angeles 22, Cal.*



FASTENERS

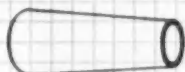


MODELL CHAINS



CHESTER HOISTS

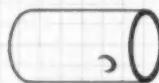




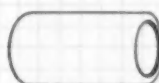
TAPERING



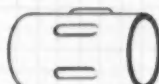
EXPANDING



DIMPLING



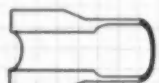
ROLLING



FLUTING



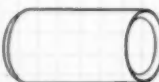
SWAGING

UPSETTING  
(Internal)UPSETTING  
(Internal-External)

REDUCING



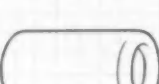
SPINNING

SLOTTING  
(Open)

CHAMFERING



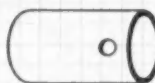
FLARING



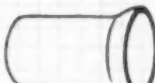
CURLING

UPSETTING  
(External)

FLANGING



DRILLING



BELLING



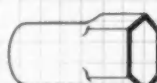
BENDING



PUNCHING



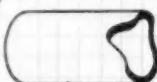
NICKING

BEADING  
(Expanded or Depressed)

SHAPING



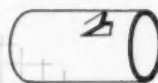
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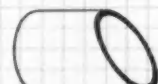
CONTOUR CUTTING



NOSING



TABBING

SLOTTING  
(Closed)

ANGLE CUTTING



FLATTENING

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The inherent "more strength with less weight" characteristic of Ostuco Steel Tubing is tailored into your product with one of these fabricating and forging operations. Basic advantages plus this versatility give you a "freedom of design" which leads to reduction of materials, production and labor costs and improvement of your product.

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225 Broadway, New York 7, New York

# News of the MACHINERY INDUSTRIES

By Charles A. Weinert

**Fast, Efficient, Presses Are Designed for Maximum Automatic Production in Which the Equipment May Be Quickly Changed to Turn Out a Variety of Parts**

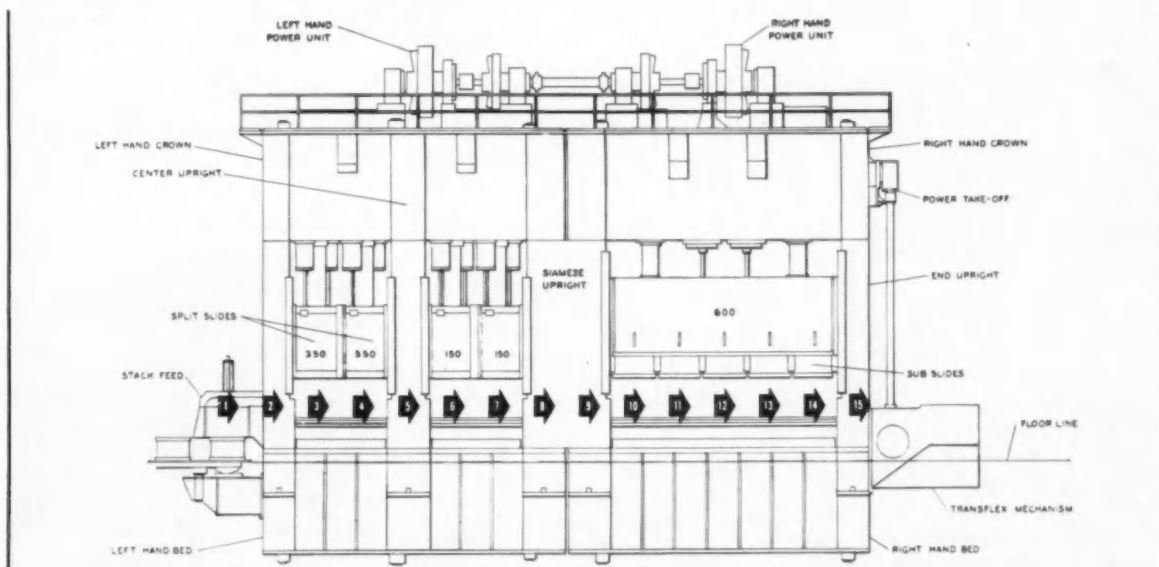
ONE of the major problems of automation is that of retaining enough flexibility in the plant's equipment so that it can be adapted to changes in product. If tremendous sums are to be invested in high production machinery that will become obsolete with any important change in the design of the part to be made, then the purchase of such machinery will be restricted to a very few shops indeed. Economical as automatic high-production equipment is upon a cost-per-piece basis, amortization of the cost over a year or two could well increase costs prohibitively.

As a means of solving this problem for the pressed metal shop,

Clearing Machine Corp., Chicago, is producing a line of presses designed for flexibility as well as high production. Flexibility on a day-to-day basis is obtained by using moving bolsters in some of the presses, so that dies can be changed in the press in a matter of minutes rather than hours. For flexibility on a longer range basis, presses are designed upon a modular system, so that the press itself can be rebuilt for other needs at much less than the cost of a new press. Other features making for versatility are variable length of feed stroke in the work transfer mechanism, adjustable feed fingers, adjustable cushion positions, skip stroke, adjustable knockout

positions, and split slides. The company refers to the basic concept as multiple purpose automation — automatic production in which the equipment may be quickly changed to produce a variety of pressed metal parts.

Several examples of this kind of press have recently been completed by the company. One, delivered to North American Aviation, Inc., incorporates double bolsters into its design, so that while the press is in operation with one set of dies, a second set may be placed on the other bolster, ready to slide into working position, be fastened by locking pins, and be ready for operation within about 5 or 10 minutes instead of as many hours. The



Sequence of operations on a completely automatic Transflex press built by Clearing Machine Corp. for the General Electric Co. in Louisville, Ky. It produces two different items without changing dies. Automatic clothes washer tops and clothes dryer tops are stamped out on alternate four-hour production shifts. (1) Blanks are loaded into the stack feed; (2) Double blank safety switch and positive stop; (3) Draw—dryer; (4) Draw—washer; (5) Idle; (6) Trim and pierce (crank up—dryer, crank down—washer); (7) Rewipe and extrude (crank up—dryer, crank down—washer); (8) Idle; (9) Idle; (10) Cam trim and pierce—washer and dryer; (11) Curl—washer; (12) Cam flange—washer and dryer; (13) Cam notch re-strike—washer; (14) Embossing—dryer; (15) Turnover.

The adjustable Transflex feed is powered by constant rotary motion obtained from the press crown through a power take-off shaft. Cams and levers transmit that motion to lateral motions in two directions, advance-return and clamp-unclamp. The length of the advance-return stroke is adjusted by a screw which changes the length of the secondary lever following the advance-return cam.

sliding bolster provides for die storage in a readily accessible location also. Additional die storage is available on the top of the press, where the dies can be swung directly onto the bolster by a crane.

Another design in which flexibility is combined with automatic operation is a huge 600-ton press built for General Electric Co., intended to, press washer and dryer tops alternately without die change. The press provides 15 stations, with 9 dies, and is said to be the world's largest completely automatic transfer press. It measures more than 58 ft. from end to end, and is more than 42 ft. high.

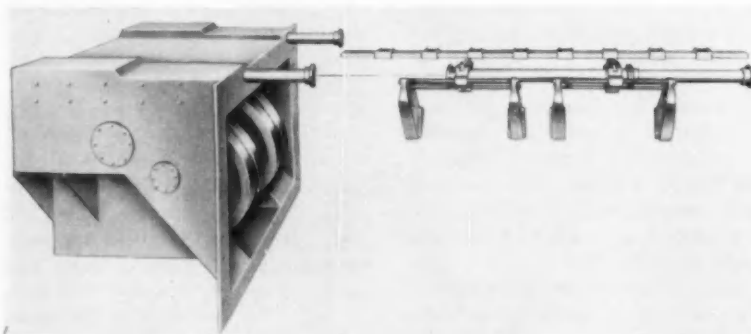
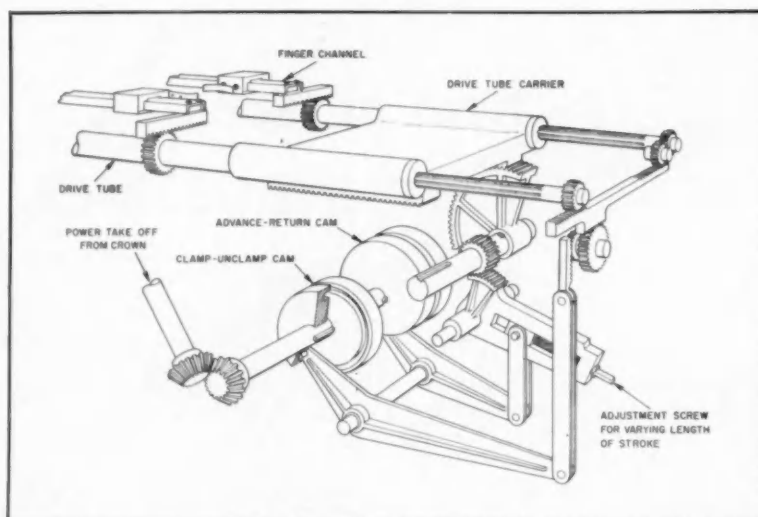
### Multiple Drill Setups For Body Trim Holes

Twelve different body trim hole patterns are provided by multi-drill fixtures installed in one of the leading automobile plants. After selection of the desired pattern, a button is pushed actuating the fixture which simultaneously drills the necessary holes in one side of the body.

Equipped with 82 Keller Air-feeddrills, each fixture is attached to the body by three air-powered clamps. Overhead suspension allows it to move along the production line with the body. Semi-automatic operation is controlled from a panel with a single button for each of the 12 hole patterns needed for different body styles. Another panel controls the actual drilling. The same pattern of holes is drilled in the other side of the body by a second fixture.

### Nuclear Tests

Close-in atomic blasts produce little serious damage to heavy duty



Feed mechanism is constructed in incremental lengths. Feeds of various lengths can be assembled by bolting together as many standard units as necessary. Each unit is supported by two pairs of brackets which are attached to the bolster plate or bed of the press.

machine tools firmly anchored in concrete. Basic tools have stood up well in test explosions. Hand valves and control levers were broken by falling debris. In one test a 200-ton capacity hydraulic press, standing 19 ft high, was placed behind a brick house in an area subjected to five psi over-pressure. The house was demolished; the press was almost undamaged.

### Illinois Gear Expands

Illinois Gear & Machine Co. is spending \$2 million in expansion at its South Works in Chicago. Building construction doubles the size of its heavy manufacturing division. More than half of the expenditure will be for new heavy machine tools. The expansion will also make added manufacturing space available at the main plant,

in which it is planned to install a considerable quantity of smaller production machine tools.

### Gardner-Denver Acquisitions

Camfield Manufacturing Co. plant in Grand Haven, Mich. has been purchased by the Gardner-Denver Co. Involved in the transfer is a building containing 68,000 sq ft of manufacturing space. Indicated purchase price was near \$160,000. The former Camfield property adjoins the main plant of the Keller Tool Div. of Gardner-Denver. It will be used to consolidate local operations of the company and to allow for future expansion of production facilities.

Acquisition of a new factory in Rio de Janeiro, Brazil, to expand  
(Turn to page 122, please)



# NEW

# PRODUCTION and PLANT

# EQUIPMENT

FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89

## A-C Electric Motors

**W**ESTINGHOUSE has announced that its line of Life-Line A industrial a-c motors has been extended to include ratings from 40 to 125 hp. Frame sizes include all NEMA designations from 364U to 445US, conforming to the new NEMA standard dimensions and providing more horsepower in smaller frames.

As in the smaller models, the new motors can be obtained in three enclosures: totally-enclosed fan-cooled, totally-enclosed non-ventilated, and drip-proof. Design features are identical with those of the smaller sizes already in use.

The new motors are designed for operation at frequencies of 25, 50 and 60 cycles at 220, 440 and 550 volts. Speeds are 3600 rpm and below. *Westinghouse Electric Corp.*

Circle 30 on postcard for more data

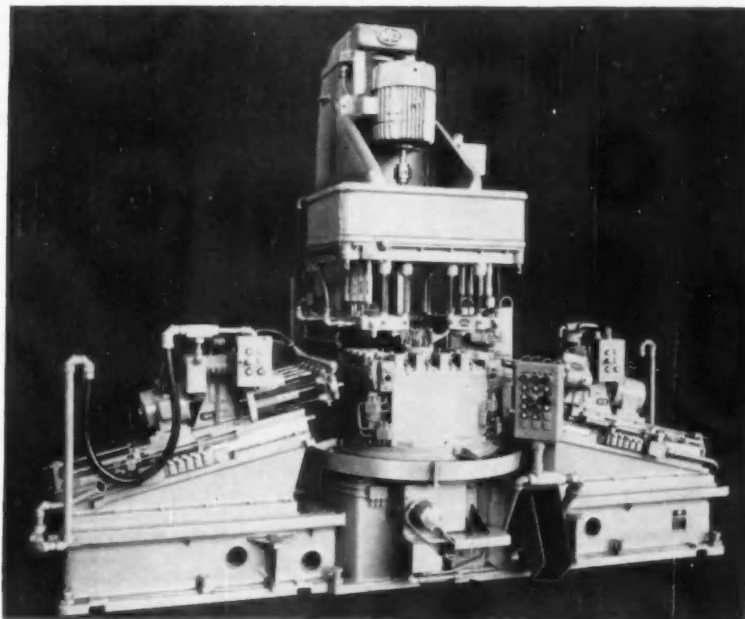
## Sensing Control

**A**N electronic capacitance control, designed to detect the correct position or size of metallic objects without contacting them, has been introduced. The control is set up to any given constant, at a given time interval, and then recognizes deviations from the constant. It not only recognizes an error, but also indicates how the sensed object is wrong—



Security electronic sensing control

either too far from, or too near to, a predetermined position or setting. The control then either stops the machine, rejects the object, or actuates correcting mechanisms. The unit can



Natco three-way driller has vertical head with 12 spindles and two angular heads with four spindles each. Output is at the rate of 756 rockerarms per hour.

## Drilling Machines Process Rockerarms at High Rate

**T**wo multiple-spindle drilling machines recently introduced process 756 valve rockerarms per hour at 100 per cent efficiency. The combination consists of a vertical Natco Holesteel machine and a three-way Natco.

The vertical Holesteel machine has 16 spindles and a six-position automatic indexing fixture. Four parts are clamped hydraulically at each position as the major hole in each part is core drilled, rough reamed,

and semi-finish reamed. Parts are automatically ejected.

The three-way Natco (illustrated) consists of a vertical head with 12 spindles and two angular heads with four spindles each. The four-position automatic indexing table holds four parts at each position. Two holes are drilled through in two steps and one is finish bottomed. *National Automatic Tool Co., Inc.*

Circle 31 on postcard for more data

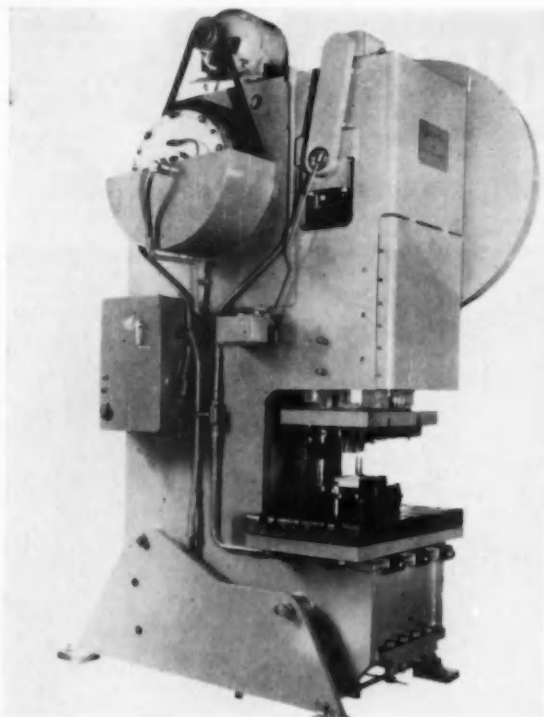
be used to check proper positioning, check proper size and shape, detect moisture change, detect ionization change in liquids, etc.

The sensing element contains no moving parts, and does not touch the sensed object. One control unit may use up to three sensing elements. The sensing element will detect objects up to two inches away, and at close proximity can recognize deviations of

1/16-in. It senses either ferrous or non-ferrous objects. The control box may be mounted 15 in. away from the sensing element, a coax cable connecting the two. Sensitivity of the sensing elements is adjustable by simple meter and distance control adjustments. The control operates on 115-v, 60-cycle power. *Security Controls, Inc.*

Circle 32 on postcard for more data

## NEW PRODUCTION and PLANT EQUIPMENT



*This Oliver - Farquhar OBI mechanical gap press is in a series recently added to the company's line of presses. Built to JIC standards, it is available in four capacities of 75, 110, 150 and 200 tons. Features include rigid frame construction, long gibways for accurate slide alignment, and box type gibs.*

### Open Back, Inclinable, Mechanical Gap Presses

NEW OBI mechanical gap presses, built to JIC standards, have been added to the Farquhar line of standard and special-duty presses. They are applicable in both large and small production runs for blanking, forming, drawing, bending and assembly operations. The design is made in four capacities of 75, 110, 150 and 200 tons.

Welded rolled steel frame construction provides high strength and stability. Side members of uniform thickness are flame-cut from heavy gage plate. There is no lamination at the throat sections. Long gibways for accurate slide alignment and box type gibs are featured in the new design. Easy wrench accessibility to the slide adjustment screw is provided at die level. Slides are box type welded steel to eliminate way deflection.

Pneumatic counterbalance cylinders that "float" the press slides and dies to reduce shock and power required to lift slides, are standard. The forged crankshaft and the gears are of heat treated steel, precision-made. Clutch is of the low inertia type where the mass of the clutch weight continues to rotate with the flywheel. Only the shaft and driving plate are started and stopped at each machine

cycle. Clutch is outboard-mounted for easy servicing.

Vee-belt motor drive is also standard equipment, with electric pushbutton safety controls. There are two "run" buttons and one "stop" button, and both "run" buttons must be depressed on downward stroke. The four-position clutch control provides for off, once, inch and continuous operation. A. B. Farquhar Div., The Oliver Corp.

Circle 33 on postcard for more data

### Plastic Compound

**C**ALLED PC-52, a new buffing compound for cutting and coloring plastics in one operation contains an ingredient that dissipates static electricity from the finished part. It is reported to provide a clear unclouded finish. The compound was primarily formulated for thermoplastic materials such as acetate, styrene and the acrylics, since these softer plastics present a greater static problem. However, it is said to be likewise giving good buffing results on thermosetting phenolics.

The composition of PC-52 includes a soft abrasive for scratch-free cutting and coloring action, a built-in

lubricant to minimize roll-over or burning problems, and the specially formulated anti-static agent. It is available in standard bar sizes for both manual and automatic application. A comparable liquid compound for automatic spray gun application is currently being developed. Hanson-Van Winkle-Munning Co.

Circle 34 on postcard for more data

### Fork Truck Upright

**C**OMBINING high stacking with low silhouette, a new three-section telescoping fork truck upright was designed for installations where fork trucks must pass through low doors or areas, yet stack loads to considerable heights. Named the "triple lift upright," the device is available in four standard sizes and, at additional cost, in seven optional sizes. In the smallest size the maximum fork height is 126 in. When the forks are lowered the overall height of the truck is only 65 in. In the largest upright size, maximum fork height is 216 in. (18 ft) and overall height with forks lowered is 96 in.

The upright is available on three models in the new Clarklift line of fork trucks: the C 30 (3000-lb capacity), C 40 (4000-lb), and C 50 (5000-lb). Industrial Truck Div., Clark Equipment Co.

Circle 35 on postcard for more data



*Clarklift truck equipped with new high-stacking three-section upright*

## Grinding Wheels

**T**HE availability of a new line of V40 mounted wheels in all standard shapes and sizes and in a range of gradings to meet all precision grinding requirements, has been announced. The new type of stronger vitrified bond, known to the trade as V40, was introduced over two years ago, and is considered by the company to be the answer to needs for an improved mounted wheel. Exceptional strength and free-cutting qualities of V40 bond are said to permit extra-fast stock removal with minimum pressure. Another stated characteristic is ability to hold size and shape, even on hard and tough metals.

The V40 mounted wheels can be supplied with hard nickel-plated mandrels in a variety of sizes to fit various chucks and to meet the demands of many operations. A special cement, high in strength and hardness, is used for anchoring the abrasive. *The Carborundum Co.*

Circle 36 on postcard for more data

## Base-Mounted Crane

**T**HE Becker Crane & Conveyor Co. has developed, and is marketing, a new base mounted jib crane. The crane features a specially designed, heavy-duty beam support bearing which provides safe load support while requiring minimum maintenance. The bearing consists of a large tapered roller bearing located at the top of the support column. Below are a pair of steel rollers which bear on a wear band welded to the column. These rollers are mounted on anti-friction bearings and are fully adjustable. The adjustment feature permits fast accurate leveling of the crane beam without the use of shims. Basic construction of the crane is such that the total beam deflection under full load does not exceed 0.060 in. per foot. The unit bolts to a suitable foundation and is not dependent on external structural members for support.

The jib crane is built in 52 sizes ranging in capacity from 500 to 10,000 lb with boom lengths from 8 to 20 ft.

Full 360 deg rotation is provided, and when electrical hoist equipment is to be used, a special commutator assembly, permitting full rotation, can be provided. Either tag line or bar electrification of the beam can be supplied.

Circle 37 on postcard for more data

*Clearing Machine Corp. has introduced a line of inexpensive trimming presses. Designed especially for removing flash from die castings, they feature low tonnage, large bed area, and simple scrap removal facilities. Shown here is a 30-ton mechanical model with a 36 by 24 in. bed; and, at right a 30-ton hydraulic model with a bed measuring 30 by 20 in.*



## Presses for Trimming Flash from Die Castings

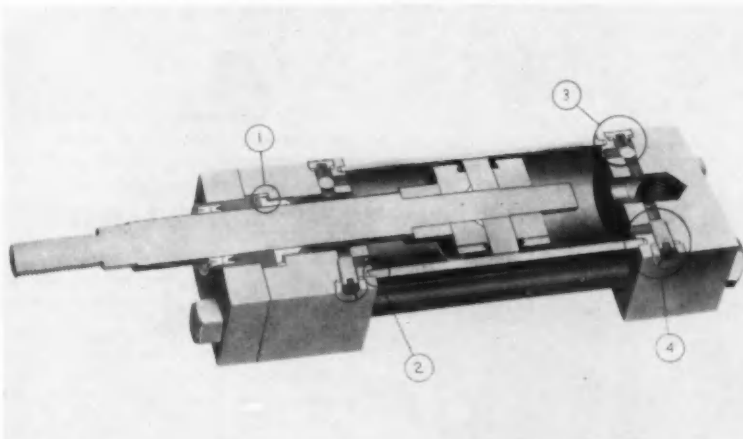
**D**ESIGNED specifically for removing flash from die castings, a new line of low-cost trimming presses features wide bed area with low tonnage and convenient bed openings for disposal of scrap. The presses are available in hydraulically or mechanically operated models.

To produce the trimming presses at low cost the company has standardized bed and slide area from 32 by 18 in. to 36 by 24 in. and 18 by 12 in. to

34 by 20 in. respectively; lengths of stroke from 3 to 12 in.; strokes per minute from 30 to 120; and tonnages beginning at 25 and going to 60 tons. Standard slide adjustments and slide knock-outs are available. Trimming presses are being offered in several variations of these specifications so customers may obtain a semi-custom unit at the low cost of a standard line press. *Clearing Machine Corp.*

Circle 38 on postcard for more data

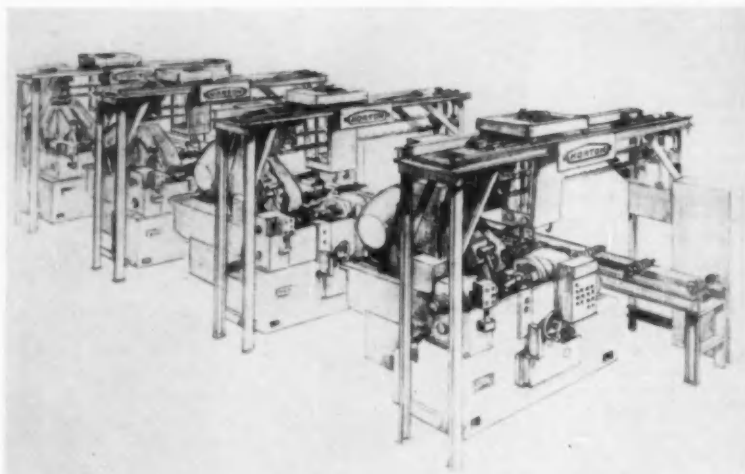
## All-Teflon Sealed Hydraulic Cylinders



*This cutaway of new Miller all-Teflon sealed cylinder shows design innovations which have enabled the use of Teflon in vital parts for longer life and added application flexibility, the upping of pressure ratings, and the introduction of new space-saving medium-to-high-pressure cylinders. Ratings on heavy-duty high-pressure units are increased from 2000 (shock)-3000 (non-shock) psi, to 3000 (shock)-5000 (non-shock) psi. The new piston rod bushing seal (1) and tube end seal (2) of Teflon replace former O-ring seals subject to extrusion and shearing. The redesigned ball check (3) is located opposite the new cushion adjusting screw (4) which has a self-regulating Teflon lock-seal. If interference makes the adjusting screw difficult to reach, it may be interchanged with the ball check. (Miller Fluid Power Div., Flick-Reedy Corp.)*

Circle 39 on postcard for more data

## NEW PRODUCTION and PLANT EQUIPMENT



Norton No. 2 unitized transfer type automatic crankpin grinding machine

### Transfer Type Crankpin Grinding Machine

THE development of its No. 2 unitized transfer type automatic crankpin grinding machine has been announced by the Norton Co. It is capable of completely automatic, high production, precision grinding. In grinding four-pin automotive type crankshafts, the machine is designed to finish-grind 240 pins per hour.

The machine consists of separate self-contained easily-regulated units. Each unit grinds a single pin on the crankshaft and grinds independently of the other units. Any unit may be cut out of service without affecting operation of the other units. The units are installed in a row, one behind the other, and are connected by means of a conveyor which carries the parts between units.

Faster work loading and unloading is possible because of double hook loading mechanism. An unground workpiece is placed in the workholders as soon as the ground piece is removed. All transferring operations are done during the grinding cycle. The loading mechanism automatically locates the work in correct position for grinding both angularly and longitudinally.

Other features of the grinder are automatic wheel truing coupled with automatic wheel wear compensation, constant peripheral wheel speed, balanced torque work spindle drive, and a system of safety interlocks to shut down the machine in case of malfunctioning.

Circle 40 on postcard for more data

### Turret Drive for Powering Self-Indexing Lathes



Pictured is a new hydraulically - operated turret drive for powering self-indexing lathes from bench size up to No. 5 turret lathes. Called the Acme Hy-drive, it can be used to automate the turret, feed the cross slide, change spindle speed, advance bar stock, reverse direction of spindle rotation for tapping, and open and close the collet. (Acme Industrial Co.)

Circle 41 on postcard for more data

### Air Line Filters

NEW automatic-drain air line filters are in a line of 24 models recently unveiled. They are said to have a simplified design of drain mechanism, more efficient liquid removal, and a wider pressure and temperature operating range. Also new is the addition of metal bowl filters to the line, in ¼, ½ and ¾-in. sizes.

Simplification of the drain mechanism has resulted in fewer parts and increased efficiency in filtering. The filters are said to operate at top efficiency at air line pressures as low as 5 psi and as high as 150 psi for the transparent bowl models and 250 psi for the new metal bowl type. They drain automatically as long as there is pressure on the air system, the float-controlled pilot-operated drain mechanism discharging when collected liquid reaches full capacity.

Liquid removal is also said to be at a greater rate, even at air flows ranging 143 per cent higher than be-



Norgren automatic-drain air line filter

fore. Redesigned louvers have improved the centrifugal action of the entering air, increasing filtering efficiency in removing moisture and oil emulsions. For removing abrasive solids from the air, three interchangeable filter elements are obtainable—74, 64 and 25 micron. C. A. Norgren Co.

Circle 42 on postcard for more data



## Injection-Molding Pellets

**L**UBRICATED Cyclocac pellets for injection molding are now available, according to a recent announcement. It is stated that external lubrication of the injection-molding pellets can result in: increase in injection speed, more effective pressure within the cavities, greater utilization of total press capacity, easier purging, reduced hold-up in cylinder dead-spots, and reduced friction within the cylinder. Marbon Chemical Div., Borg-Warner Corp.

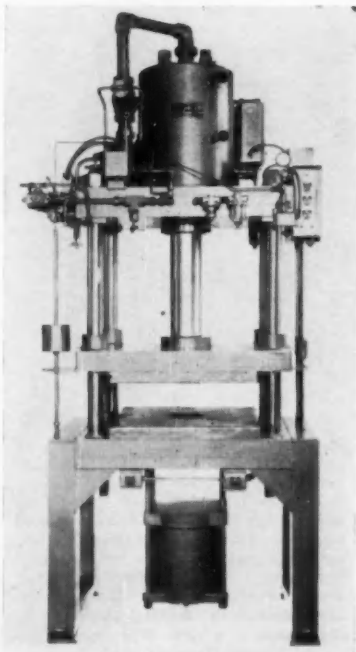
Circle 43 on postcard for more data

## Hydraulic Presses

**F**AST-ACTING presses are being offered in a line recently developed for application in the metalworking, plastic, ceramic and other industries. Using a new accumulator principle combined with a shock-free hydraulic system, rapid cycling action is achieved with low horsepower input. Speeds up to 2000 ipm ram travel are provided.

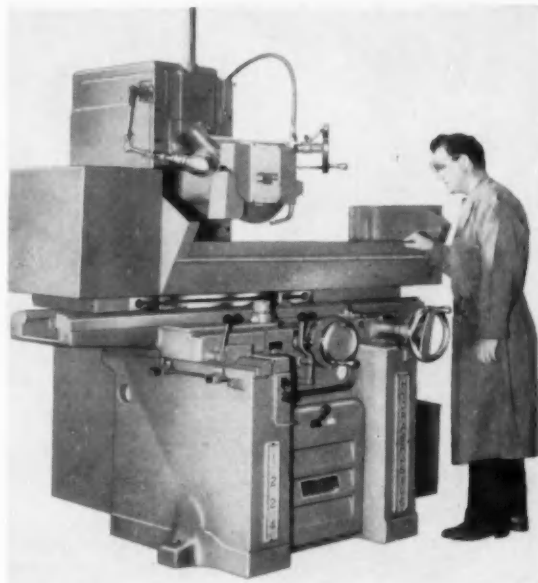
Named the 2600 Series, the design is available in capacities from 1 to 600 tons. Features include C-frame, two and four post and gib guide designs, rigid construction, and minimum floor space requirement. Kard Manufacturing, Inc.

Circle 44 on postcard for more data



Kard 2600 series hydraulic press

*Hydrabrasive precision surface grinder is offered in three model sizes making up a new line. Features include large capacity and new spindle design, hydraulic system and cross-feed saddle construction*



## New Line of Precision Surface Grinders

**H**YDRAULIC precision surface grinders in a new series were recently unveiled. Three model sizes make up the Hydrabrasive line: Model 824, 8 by 24 by 12 in.; No. 1218, 12 by 18 by 12 in.; and No. 1224, 12 by 24 by 12 in. Featured are large capacity, a new spindle design, a new hydraulic system which minimizes heat, and a newly-designed cross-feed saddle adjustment.

To provide flexible capacity, all standard models have 12 in. of grinding clearance to the table under a 12-in. wheel. Optionally, they can be built with 18 in. under a 12-in. wheel. Also, 24-in. models can be safely extended to 30 in. in length.

The spindles are lifetime sealed lubricated, and have anti-friction preloaded bearings. All components are balanced after assembly. To eliminate any possibility of binding on the column ways, the head and spindle assembly is balanced on the elevating screw.

The design minimizes heat usually associated with hydraulically-powered machine tools. The Hydrabrasives have two hydraulic cylinder rams to actuate the table. Each ram is under pressure only half the time, allowing a period for cooling. The ram is the piston, eliminating out-of-line piston rods. The hydraulic system is low pressure (200 lb operating pressure); and normal temperature rise in the system is only 20 F. For inspection, the power system rolls on casters out

the front of the machine. The coolant system is located outside the machine to prevent heat transfer from that source.

Another advancement is the newly-designed cross-feed. For highly accurate transverse saddle adjustment, the machines have a precision ground cross-feed screw without backlash and with ball-bearing saddle ways. The saddle moves on  $\frac{3}{4}$ -in. preloaded ball bearings on hardened steel square ways. The hydraulic motor turns the screw for rapid saddle traverse when dressing wheel. Abrasive Machine Tool Co.

Circle 45 on postcard for more data

## Skid Adapter

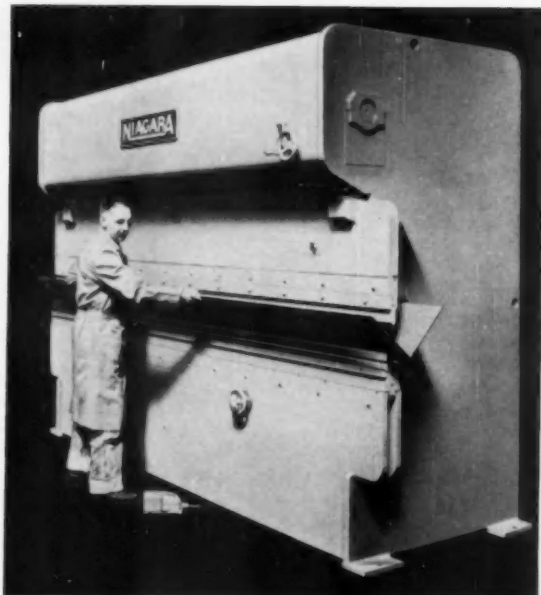
**A** SKID ADAPTER has been designed by The Raymond Corp. for its 24-v electric walkie truck, allowing the unit to handle both skids and pallets with loads up to 4000 lb. The steel frame of the adapter is locked in an upright position when the truck is moving pallets. To handle skids the operator releases the lock, letting the skid adapter swing down into position over the forks.

The adapters can be furnished to handle skids of any standard under clearance and have the same dimensions as the forks which are offered in 24, 27 and 30-in. widths and 30 to 60-in. lengths.

Circle 46 on postcard for more data



## NEW PRODUCTION and PLANT EQUIPMENT



*Niagara press brake of all-new design features totally-enclosed construction and improved operating characteristics. Two models, with capacities of 30 and 50 tons and with overall bed lengths of 6 to 12 ft. are available.*

### Press Brake of Totally-Enclosed Construction

**S**TREAMLINED design and advanced power are featured in the introduction of a new press brake. Said to be all-new, its power clutch, power brake and power treadle are designed for smooth action and instant response. The electro-pneumatic friction clutch and brake work together to permit the ram to be inched down smoothly; and a portable treadle adds operator convenience.

Totally-enclosed construction is used. The entire drive is inboard, including motor, belts, flywheel, clutch,

brake and gears, as well as connections, pitmans and ram adjustment mechanism. The rigid one-piece frame with wrap-around crown provides resistance to deflection and maintains alignment of bearings and ram. A 50 per cent deeper throat is made possible by the incorporation of heavier, deeper uprights.

The new press brake is available in 30 and 50-ton models, with overall bed lengths of 6 to 12 ft. *Niagara Machine & Tool Works.*

Circle 47 on postcard for more data

### Circle-Cutting Tool

**A**N outside circle cutting attachment for use with Pullmax Models P-3, P-5, P-7 and P-9 universal shearing and forming machines, has been added to the company's line of accessories.

On the larger model machines, namely the P-7 and P-9, a power feed is available and when the outside attachment is used in conjunction with this feed, capacity and versatility are materially increased. With the installation of the attachment, circles of large diameter, as well as rings and large radii, can be cut. Another use for the attachment is that of straight shearing. By employing two straight guides and a power feed, it is possible to cut large sheets and inside square holes in heavy plate.

Included with the attachment are

a guide rail and a center pin. It is normally supplied in four-foot lengths, but other lengths may be obtained. Fastened to the side of the machine, the attachment swings out of the way when not in use. *American Pullmax Co., Inc.*

Circle 48 on postcard for more data

### Liquid Detergent

**O**AKITE LSD is a liquid detergent for use in steam cleaning equipment which has just been introduced. Developed to simplify the preparation of steam cleaning solutions and to reduce the clogging of coils in self-generating equipment, it will handle a variety of steam cleaning operations from light to medium-heavy duty. The material is said to provide effective soil removal at concentra-

tions of one to two ounces to each gallon of water.

Used as recommended, it is claimed to be safe on steel, brass, and magnesium, and to have no effect on painted surfaces. Its solutions have a pH of 12 in the operating range. No offensive fumes are produced in use, it is reported. *Oakite Products, Inc.*

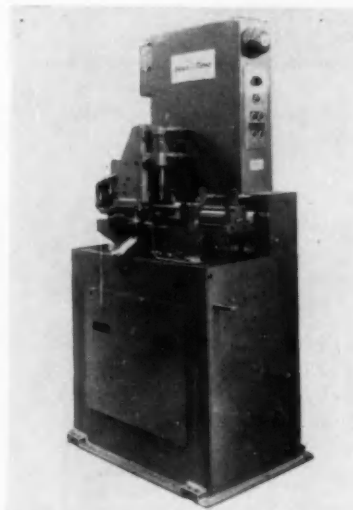
Circle 49 on postcard for more data

### Surface Plate Stands

**S**TEEL stands of new designs have been developed to accommodate black granite surface plates. They range in size from 12 by 18 in. to as large as 10 by 20 ft. The stands are rigidly constructed of heavy gage angle iron, reinforced to withstand from three to six times the weight of the respective surface plates. Overall working height is 36 in., but can be made at varying heights as specified. Casters or leveling screws can be furnished according to user's needs. *Col-lins Microflat Co.*

Circle 50 on postcard for more data

### Valve Lifter Tester



*Strength of a brazed joint in automotive valve lifters is automatically tested, at the rate of 1800 per hour, on this high-speed ram test unit. Self feeding, the machine applies a 3000-lb load to make sure that the end of the lifter foot will not break away from the cylindrical body. Faulty parts are automatically rejected. Similar machines can be used for functional leak-down test for proper fit of the plunger in a valve lifter body. (Cargill Detroit Corp.)*

Circle 51 on postcard for more data

## Coil Lifters

**H**YDRAULIC and electro-hydraulic coil lifters in a wide range of capacities have been introduced in a new line. Of all-steel construction, each has a vee-type deck to facilitate the handling and lifting of coils of varying sizes. All have four flanged wheels for operating on tracks.

The 4000-lb capacity hydraulic coil lifter handles coils with as much as a 48-in. overall diameter and 30-in. width. Through the action of a double-acting hand pump, it will lift coils to heights of 18 in.

Coils weighing up to 5000 lbs can be handled with the hydraulic footlift coil lifter. This unit handles coils of 36-in. widths and as much as 48-in. diameters. By use of the foot pedal, coils can be easily lifted as much as nine inches.

Also available is the Model WHE 10-30 hydraulic handlift coil lifter with an 8000-lb capacity. Actually a modification of a handlift truck, the Model WHE uses its pulling handle, when engaged, as the lifting device.

For coils weighing as much as 10,000 lb, an electro-hydraulic coil lifter is offered. Designed to handle coils with diameters as much as 48 in. and 30 in. widths, lifting and driving the unit is accomplished through electro-hydraulic power. Coils can be lifted to 12-in. heights.

Heavier coils are handled with the 20,000-lb capacity electro-hydraulic traction drive coil lifter. This unit will handle coils 50 in. wide of any diameter. Like the 10,000-lb model, it has a power lift (to 12 in.) and is power propelled. The convenient throttle levers also allow "inching" the unit into position with a high degree of accuracy. *Lewis-Shepard Products, Inc.*

Circle 52 on postcard for more data

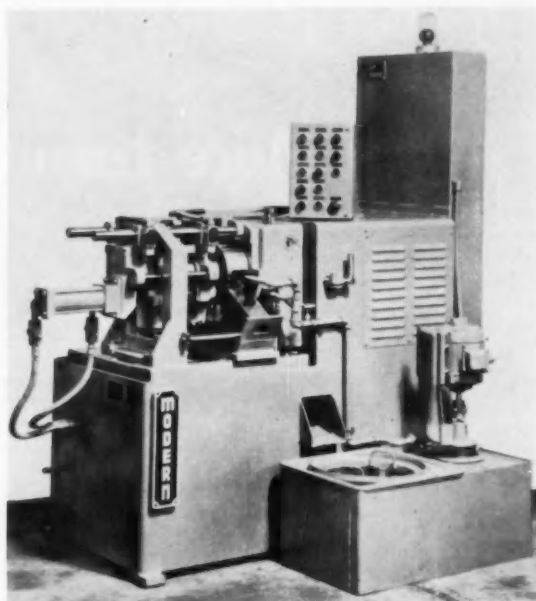
## Alloy Steel Studs

**N**EW alloy steel studs which are double drawn and heat treated to prevent thread distortion and stud failure, are being offered for use principally in tool and die work for machine and fixture setup. They are said to last up to five times longer than ordinary studs. Tensile strengths of over 125,000 psi are reported.

The studs are available from stock in quarter-inch-multiple lengths up to 12 in., in diameters of  $\frac{1}{4}$ ,  $\frac{5}{16}$ ,  $\frac{3}{8}$ ,  $\frac{1}{2}$ ,  $\frac{5}{8}$ ,  $\frac{3}{4}$  and 1 in. *Jergens Tool Specialty Co.*

Circle 53 on postcard for more data

*Automated Burr-Master, developed by Modern Industrial Engineering Co., deburrs and chamfers (in two work positions) ends of teeth in a 3/16-in. groove of an automotive gear. The automation equipment—working from a single air cylinder and four limit switches—moves, positions in both stations, chamfers, and ejects parts in six seconds. Production rate is 600 per hour.*



## Automated Gear-Tooth Deburring Machine

**I**NTRODUCTION of a new universal two-station deburring and chamfering machine with integrated automation equipment has been announced. Designated Model BMED-14S, it chamfers and deburrs gear teeth at both ends of a groove. Each part is automatically processed through two work positions in a cycle time of six seconds at a rate of 600 parts an hour. Although the automation equipment is custom-tailored, the basic universal machine will handle spur gears, helical and straight-sided as well as involute-form splines from  $\frac{1}{8}$  to  $6\frac{1}{2}$  in. PD. Production rates of up to five teeth per second per side can be assured.

The automation equipment works off only one ( $3\frac{1}{4}$ -in. bore, 6-in. stroke) air cylinder and four interlocked limit switches. For easy tool access, it is mounted on two guide bars—loosening two screws is all that is necessary to move it out of the way. Repositioning is accomplished by sliding it back against positive stops.

At work, parts are fed from a distribution system to the "in" slide and chuted to a stop where they are checked by mechanical fingers for proper horizontal position. If misaligned, the machine automatically shuts itself off (and flashes a red light as a visual signal) until manually cleared. Properly oriented parts continue through the chute, butting against a spring-loaded gate for re-

tainment prior to entering the machining cycle.

One part enters the index fixture at a time—it is moved to a work station and positioned against springloaded bushings. As the dovetail-form cutters are stroked across the part face being chamfered, a pilot gear electrically counts the number of teeth. When completed, the counter stops the machine with the cutters in a retracted position. The part is then moved (with another part taking its place) to the second work station where the other face of the groove is chamfered by the same method. From here, the part is chute-ejected.

The indexing mechanism is made up of an index plate (or barrel) having an independently operated outer sleeve. The sleeve moves back and forth around half the periphery of the cam-controlled barrel and controls the entry and ejection of parts by dog actuation of gates. Operational sequence, controlled by movement of the air cylinder's quill, is: (1) start cycle; (2) trip limit switch to energize electric clutch and de-energize electric brake which starts chamfering action; (3) timer-counter controls number of teeth being cut; (4) count-out de-energizes clutch, energizes brake, and actuates a solenoid to start quill return; and (5) quill return closes all limit switches which repeats cycle. *Modern Industrial Engineering Co.*

Circle 54 on postcard for more data



## Enjoy Butyl adds to new car performance



**Here are 104 of the Enjay Butyl rubber parts contributing to the outstanding performance of the 1957 Pontiac cars.**

Enjoy Butyl, the super-durable, all-weather rubber, has been Pontiac's choice for important rubber parts for the past eleven years. This year, in more parts than ever before, Enjay Butyl rubber is adding strength, durability, and beauty for safer, more luxurious driving.

Readily available in non-staining grades, Enjay Butyl rubber can be compounded into white and light-colored parts that combine beauty with top-notch performance. Low in cost, it out-performs and out-lasts all other rubbers formerly used, and may well be able to *cut costs and improve performance* in your product. For further information, and for expert technical assistance, contact the Enjay Company.



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## FREE LITERATURE

### Electric Motors 1

Torque motors, special motors, and collector rings for completing electric circuits between stationary and rotating parts are covered in an eight-page bulletin issued by *The B. A. Wesche Electric Co.*

### Dust Collector 2

Bulletin VRU-4-57, eight pages, supplies details on a redesigned vertical-rotor wet-type dust and fume collector that features high efficiency and relatively low cost. *Schmieg Industries, Inc.*

### Synthetic Rubber 3

Selection of filler materials that can be used with Enjay Butyl, a general-purpose synthetic rubber, is simplified by means of a slide chart made available by *Enjay Co., Inc.*

### Die Sets 4

Catalog 56, 28 pages, lists a series of die sets and supplies, including a removable cap pin that facilitates parting large and small die sets by eliminating binding. *Superior Steel Products Corp.*

### Silicone Grease 5

A silicone-based grease, Dow Corning 41, developed primarily for high-temperature slow-speed bearings, is covered in Brochure 6-206, four pages. *Dow Corning Corp.*

### Leak Detector 6

Catalog GEC-836B, 12 pages, explains a mass spectrometer leak detector that locates leaks in vacuum and pressure systems. *General Electric Co.*

### Voltage Regulators 7

An eight-page engineering paper explains how corona-type regulators may solve voltage regulation problems without the use of multi-tube circuits. *Victoreen Instrument Co.*

### Gearmotors, Drives 8

Booklet DB-3650, eight pages, includes information on various types of gearmotors and package drives with a speed range of from 7.5 to 780 rpm. *Westinghouse Electric Corp.*

### Liquid Lock 9

Technical Report No. 5, 12 pages, gives detailed information on how to lock threaded fasteners with a liquid plastic called Loctite, which can also be used for sealing and soldering sleeve joints. *American Sealants Co.*

### Hydraulic Fittings 10

A 20 by 28 in. wall chart on fittings, that provides a handy aid to engineers in designing hydraulic and fluid systems for aircraft, is being offered by *Aviation Div., The Weatherhead Co.*

(Please turn page)

8/15/57

VOID After Oct. 15, 1957

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## FREE LITERATURE—Continued

**Gray Iron Castings 11**

An eight-page folder outlining the contents of 15 publications dealing with the selection, purchase, design and fabrication of gray iron castings has been issued by *Gray Iron Founders' Society, Inc.*

**Instruments 12**

Catalog C-704, eight pages lists a variety of instruments, including expanded scale volt and frequency meters, transformation ratio meters, new nuclear scalars, recorders and readouts, and an analog computer with digital input and output. *Berkeley Div., Beckman Instruments, Inc.*

**Fork Lift Trucks 13**

Gasoline or LPG-powered fork lift trucks with capacities of 5000 and 6000 lb are described in two new bulletins, 1348A and 1395. *Baker-Raulang Co.*

**Blind Rivets 14**

Ten-page catalog, Form 8-409, lists the advantages of two types of blind rivets and illustrates a number of typical applications with cross-section drawings. *Huck Manufacturing Co.*

**Control Centers 15**

A 16-page manual discusses the planning of control centers for centralizing electrical power distribution and motor control equipment. *Square D Co.*

**Wear Steel 16**

Bulletin 11-3, four pages, contains information on an abrasion-resisting steel supplied in both sheet and plate form. *Joseph T. Ryerson & Son, Inc.*

**Al Index 17, 18**

Check 17 on postcard for index to Vol. 116 (Jan. 1 to June 15, 1957) of *AUTOMOTIVE INDUSTRIES*. A limited number of copies of the index to Vol. 115 (July 1 to Dec. 15, 1956) are also available. Check 18 if you wish this index also. *AUTOMOTIVE INDUSTRIES*.

**Reproduction Films 19**

A six-page folder describes the new Cronaflex line of engineering reproduction materials on a polyester photographic film base, which may be used for making "second originals" or prints of drawings. *E. I. du Pont de Nemours & Co.*

**Control Device 20**

Publication E-1000, 60 pages, describes applications of the Magalip, a device for remote indication that can also be used to control mechanical, electrical, and hydraulic mechanisms or servos. *Muirhead Instruments, Inc.*

**Liquid Meter 21**

A stainless steel industrial liquid meter for the measurement of corrosive liquids is covered in Bulletin 94/10, four pages. *Neptune Meter Co.*

**Turret Lathes 22**

Catalog VTL-3, 24 pages, gives the features of a line of 32-, 42-, and 52-in. vertical turret lathes, and also describes a tape automated numerical control system and a precision tracer control system. *Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co.*

**Ground Power Units 23**

An 18-page report discusses ground power units and compares operating costs of gasoline, Diesel, and LP-gas engines. *Motor Generator Corp.*

**Pusher Furnaces 24**

Bulletin P-57 covers standard, controlled-atmosphere, multi-zone, pusher-type continuous furnaces for carburizing, carbo-nitriding, and general heat treating applications up to 1850° F. *Ipsen Industries, Inc.*

**Expanders**

Mechanically and hydraulically-powered metal expanders are covered in Bulletin 557, eight pages, which discusses expander selection, operation and tooling. Write on company letterhead to: *Grotnes Machine Works, Inc., 5454 North Wolcott Ave., Chicago 40, Ill.*

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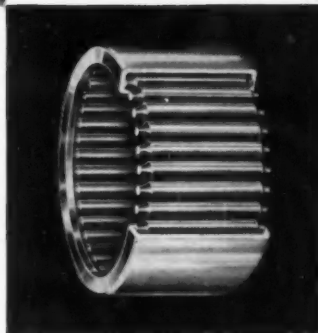
Massey-Harris-Ferguson, Inc. uses six Torrington Needle Bearings in the F-EO-20 and F-EO-35 Dyna-Balance Mowers for ease of assembly, compactness, smooth operation and long service life.

## How to cut a swath— faster and smoother

First successful high-speed, vibrationless mower offered the American farmer is the Ferguson Dyna-Balance Mower. By eliminating vibration, operator fatigue is reduced, service life extended and production potential increased.

To keep friction low and operation smooth, six Torrington Needle Bearings are used on knife head and lever pivot pins. They contribute to easy assembly, light weight and compactness while providing maximum load capacity and long service life.

Such features have led to the extensive use of Torrington Needle Bearings in all types of farm and automotive equipment. If we can be of service to you in engineering Torrington Needle Bearings into your equipment, please call on your Torrington representative. *The Torrington Company, Torrington, Conn.—and South Bend 21, Ind.*



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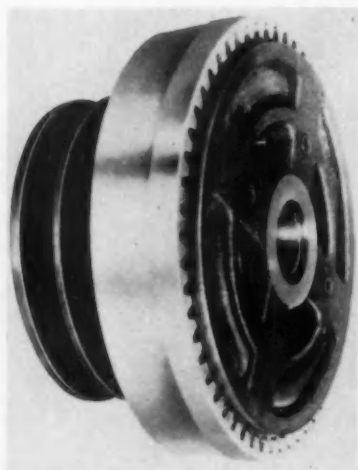
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**NEW****PRODUCTS**  
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FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89

**Automatic Clutch**

Rapid heat dissipation by a built-in ventilating system is the stated outstanding feature of a new automatic clutch now available. Called the 800 Series, it has been engineered for



use on both electric motors (2 to 5 hp at 1750 rpm) and gasoline engines (6 to 9 hp). Its cooling design is said to make it ideally suited for loads requiring extended acceleration periods.

The clutch is also said to have an unusually large friction area (40 sq in.) for an automatic clutch in this capacity range. Its compact design and construction incorporate relatively few parts which are easily serviced and required minimum maintenance. The unit accommodates a selection of detachable sheaves for versatile application. *Salsbury Corp.*

Circle 60 on postcard for more data

**Flooring Adhesive**

Developed especially for installing bus flooring in production line operations, a new adhesive is designed to give quick tack and high early strength. Called LG-735, it is a water-based, trowelable, gray-white rubber-latex resin emulsion usable for installing all types of linoleum with

Armstrong Hydrocord, burlap or felt backing, on steel, wood and some composition surfaces. It also can be used for bonding linoleum and rubber tile to the same kind of surfaces. The material is said to give a strong yet flexible bond; and when dry is both alkali- and moisture-resistant. *Armstrong Cork Co.*

Circle 61 on postcard for more data

**Resistant Coating**

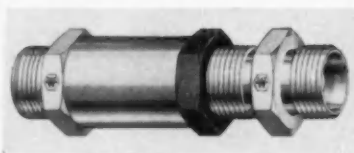
Chemical-resistant coatings are obtainable by the use of a material recently introduced. Called Rubber-Coat Liquid Hypalon, it is in the form of a brushable or sprayable liquid. It is said to be inert to almost any type of chemical attack; and comes in white, black and six colors. Temperature range is +350 to -40 F.

The material is also stated to be desirable for electrical and electronic equipment inasmuch as it is unaffected by ozone. It is likewise unaffected by petroleum derivatives. *The Wilbur & Williams Co.*

Circle 62 on postcard for more data

**Adjustable Union**

An adjustable flareless union is now being manufactured as an assembly aid in hydraulic systems requiring full space utilization. It is usable in areas of aircraft and missile application where space does not allow the tubing to be sprung to accommodate that portion of the tubing which must be positioned within



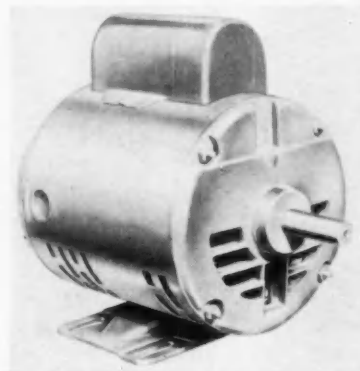
the connector. The adjustable union is available in the -4, -6, -8, -10, -12, -16 and -20 sizes. It can be used in hydraulic systems for 3000 psi service. *The Weatherhead Co.*

Circle 63 on postcard for more data

**Re-Rated Motors**

Designed in NEMA frames 56 and 48, a line of motors recently introduced is available in ratings from 1/8 to one horsepower in polyphase, capacitor single phase, permanent split capacitor and (in the smaller ranges) split phase types. Substantial reductions in weight and size of the motors, designated Model R, have been achieved by the use of aluminum and by the more effective design application of copper and steel. It is said that many of the redesigned ratings weigh less than half as much as the equivalent power in the older frames.

A new ventilating system has helped make it possible to put many rat-



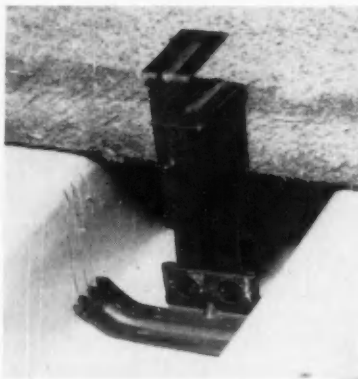
ings, usually expected only in the 56 frame, into the smaller 48 frame. Thus, such ratings as 1/8 and 1/4 hp, 1725 rpm, single phase motors are offered in either 56 or 48 frames. In special designs, especially at 3450 rpm, ratings of 1, 1 1/2, 2 and 3 hp are available.

Mylar polyester film is used for slot cell insulation as well as in other strategic locations. The terminal box is built into the die-cast aluminum end head. Motors are obtainable with either sleeve or fully sealed ball bearings; and in both totally-enclosed fan-cooled and totally-enclosed non-ventilated construction for extra protection against dirt, dust and moisture. *Robbins & Myers, Inc.*

Circle 64 on postcard for more data

## Insulation Fastener

Non-piercing mechanical fasteners for attaching roof insulation to various types of metal channel decks have been introduced in a complete line. Called GAT Dek-Clips, they have sharp serrated teeth at each end of the foot element which grip the sides of the deck flute when the clip is driven into place. After in-



stallation the clip resists a pull-out pressure in excess of 200 lb.

When being applied the clip is snapped into a simple cast iron GAT-Dek tool which in turn is placed vertically against the edge of the insulation and driven into the flute of the deck by hammer blows on the head of the tool. The next section of insulation board is then butted against the board already in place so the edge is snug against the upright leg of the last preceding fastener. Since the fastener has opposing tabs, one clip serves as a common anchor for two abutting boards. *Geo. A. Tinnerman Corp.*

Circle 65 on postcard for more data

## Stainless Sheet

Low cost and ability to withstand operating temperatures as high as 1500 F are featured in the introduction of a new stainless steel sheet. Its price is approximately 49¢ per pound. The process used in its manufacture involves the diffusion of chromium into the surface of the steel where an iron and chromium atom exchange takes place, forming a stainless surface integral with the base metal. Since the high temperature is followed by slow cooling, the sheet becomes annealed at the same time. The company claims its newly-developed product is easily worked,

and can be bent, drawn, swaged, formed, spun or welded without peeling or cracking. *Chromalloy Corp.*

Circle 66 on postcard for more data

## Leather Cups

Cups and packings that give longer service life through improved design are being offered in a new line. Made of Sirvis or Sirvis-Conpor (elastometer impregnated) mechanical leather, the cups are preformed on special dies to produce a sharp, rather than round, heel. Stated advantages of the molded design are greater density at the heel of the cup, and the pre-forming to shape which conventional cups are forced to assume under pressure of application.

Tests conducted with conventional and new sharp-heel molded cups, run in a hydraulic cylinder for 3000 cycles at 6000 psi, showed marked wear and distortion at the heel of the conventional cup, little if any appreciable wear on the molded design. Field tests in heavy-duty applications at oil pressures up to 3500 psi and in air cylinders at 150 psi also have established greatly increased service life. *Chicago Rawhide Manufacturing Co.*

Circle 67 on postcard for more data

## Weld Nuts

Two new weld nuts, consisting of a pilot type and a recessed type, were recently introduced. Both are projection weld nuts engineered for simplification of assembly and welding to sub-assemblies.

The pilot type (illustrated) automatically locates itself in hole punched in the sub-assembly, eliminating the need for jigs or special locating fixture. The pilot also forms a barrier between threads and weld, avoiding weld spatter on the threads.

The recessed type weld nut has a



recess around the hole to prevent clogging of the nut by weld flow or spatter—no retapping is required.

Both types are available with or without the company's patented two-way locking feature (AI, Feb. 15, page 93) which provides a lock in the middle of the nut. *MacLean-Fogg Lock Nut Co.*

Circle 68 on postcard for more data

## Load Compensator

Designed to prevent rear spring sagging on heavily-loaded passenger cars, a new product combines an oversize shock absorber and overload coil spring. The shock absorber is calibrated to control both the standard equipment spring on the vehicle and the overload spring. Named the Monroe Load-Leveler, the unit is said



to provide heavy load capacity together with a smooth, stable ride under heavy, normal or light loads. It replaces rear shock absorbers, one on each side, using the same mounting holes.

Company engineers state that road clearance of a heavily-loaded car is increased 35 to 40 per cent; and that clearance of a car with normal load is increased 12 to 17 per cent. It is further indicated that a four-door sedan, equipped with the device and loaded with six passengers and 500 lb of luggage, still maintained a level and comfortable ride. Also that on the same car, with only one or two passengers and no luggage, the leveler gave a non-sway, stabilized ride. *Monroe Auto Equipment Co.*

Circle 69 on postcard for more data



# The BUSINESS PULSE

**Increasing Living Costs Indicate that Price Pressures Are Still Strong. No Extension of Upturn in Housing Starts, Instead a Moderate Decrease Was Registered During June. Flurry of Automobile Sales Subsided Last Month.**

The somewhat paradoxical contrast persists between vigorous financial activity on the one hand and the more static character of actual business operations on the other.

Loanable funds continue in limited supply, as dramatized by the Treasury's recent 4 per cent offering. And price pressures are still strong, at least in some sectors of the economy, to judge from the increase in living costs in June for

This Survey Is Prepared Exclusively for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Company of New York.

the tenth consecutive month. These conditions have kept talk of inflation very much alive, and they have prompted increasing speculation in financial circles as to the possibility

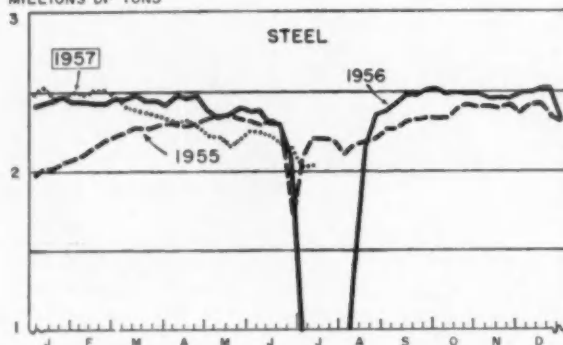
of increases before long in certain key rates established by lenders, including the so-called prime rate of commercial banks.

## Business Continues Spotty

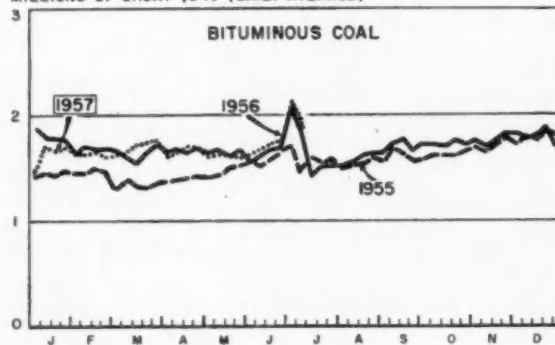
Alongside this situation, the spottiness of general business activity continues. Over-all indicators for the most part are still in a sideward drift and in some cases appear to be in a moderate decline.

(Continued on page 104)

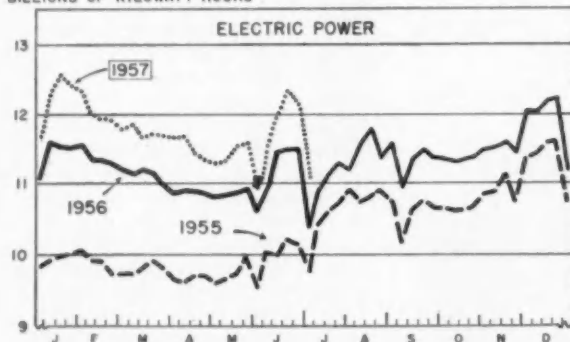
MILLIONS OF TONS



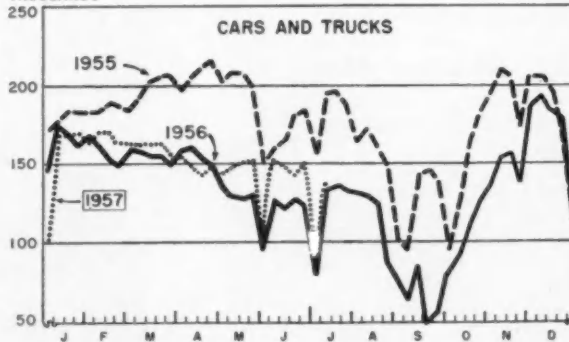
MILLIONS OF SHORT TONS (DAILY AVERAGE)



BILLIONS OF KILOWATT HOURS



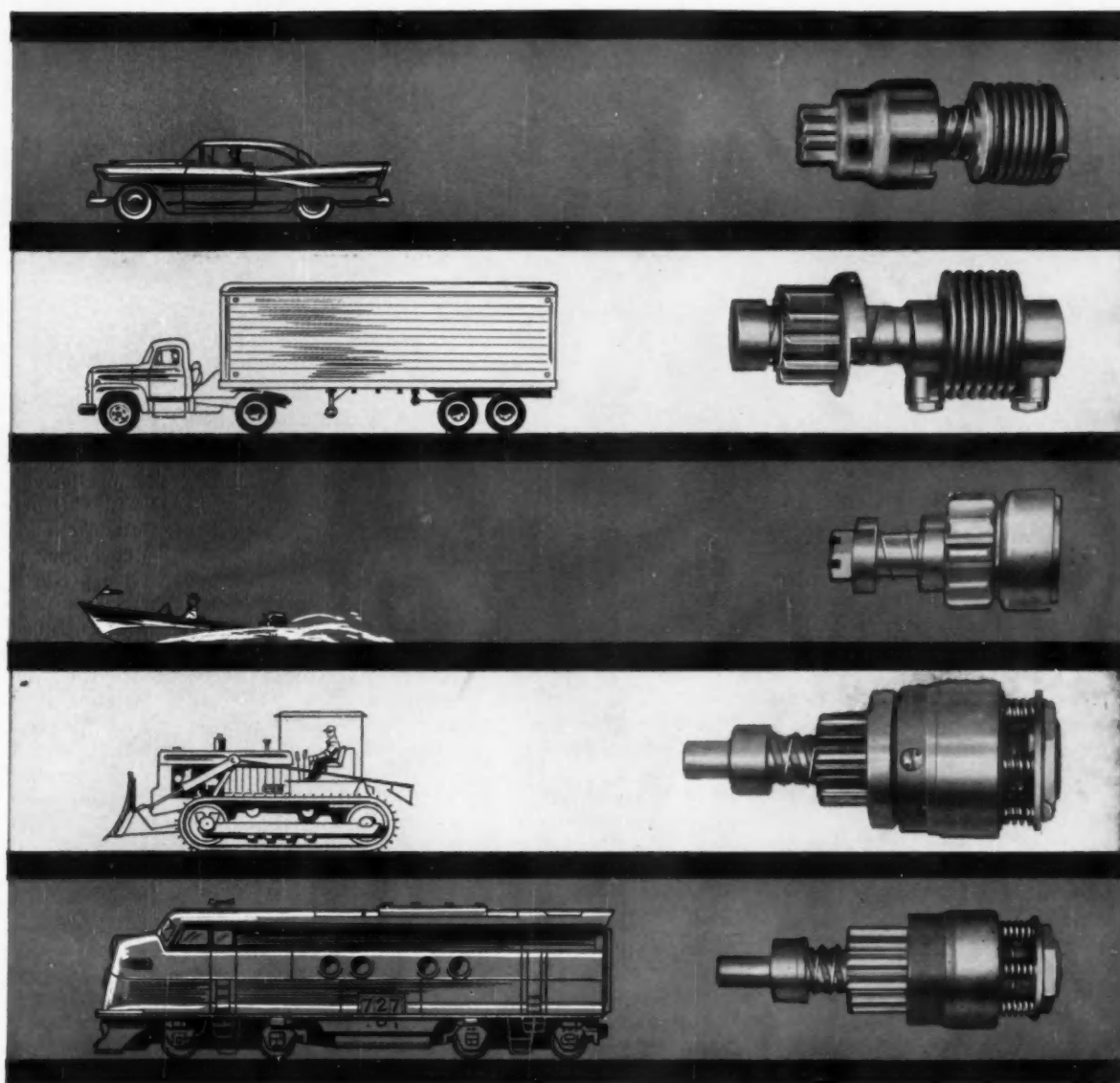
THOUSANDS



SOURCES: AMERICAN IRON AND STEEL INSTITUTE, DEPARTMENT OF THE INTERIOR, EDISON ELECTRIC INSTITUTE, AND WARD'S AUTOMOTIVE REPORTS.

COUNCIL OF ECONOMIC ADVISERS

**Weekly Indicators of Production.** Several weekly indicators of production increased in June. Exceptions were steel, which was about the same as in May, and paperboard, which dropped slightly. However, in early July all indicators declined as a result of the holiday.



## BIG OR SMALL . . . BENDIX DRIVES START THEM ALL

Throughout the world of transportation it's an accepted fact that *you start with Bendix!* And it's not surprising. Bendix\* Starter Drives have been synonymous with dependability for fifty years in the automotive field. They've proved themselves just as reliable on submarines, aircraft, earth movers, outboard motors, helicopters. In fact, every type of internal-combustion

engine ever built has used a Bendix Starter Drive. Hospitals use Bendix Drives to activate their stand-by equipment. Air raid sirens across the country are started with Bendix Drives. It's logical to believe that such universal acceptance indicates a standard of quality which no other manufacturer has been able to match. Need we say more?

\*REG. U. S. PAT. OFF.

**Bendix-Elmira, N.Y.**  
ECLIPSE MACHINE DIVISION



# AIR BRIEFS



By **RALPH H. McCLARREN**

## Fairchild F-27

Production of the 40 passenger turboprop F-27 is moving ahead at Fairchild Aircraft Division, Hagerstown, Md. The twin engine (Rolls-Royce Dart engines) high wing transport was designed as a replacement for the DC-3. It is ideally suited for short-haul operations and off and into the smaller airports.

As of July 15, 1957, 12 local service airlines have ordered 46 F-27's with options for 21 more. Also 14 corporations have ordered a total of 15 of the aircraft from Fairchild. Airlines ordering the F-27 include West Coast, Mackey, Piedmont, Frontier, Bonanza, Quebecair (Canada), A. R. E. A. (Ecuador), Northern Consolidated (Alaska), Avenza (Venezuela), Wien (Alaska), Wheeler (Canada), and Southwest. Among the corporations are Continental Can, General Tire, Butler Aviation and Bank of Mexico. Extensive use is being made of bonded sandwich structure known as Metalbond and Redux. Two new buildings are being constructed by Fairchild increase production of the F-27. Deliveries are scheduled to begin in February of 1958.

## New Air Force Fighter-Bomber

Referred to as the World's most powerful fighter-bomber, the F-105 Thunderchief made its debut to the public on July 28th. Built by Republic Aviation Corp., Farmingdale, Long Island, the supersonic F-105 was demonstrated as part of a mammoth air show at Andrews Air Force Base, Washington, D. C., celebrating the 50th anniversary of the U. S. Air

Force. This was opening day of the Air Force Association's annual meeting.

The Thunderchief is powered by a single Pratt and Whitney J-75 turbojet engine which develops in excess of 15,000 lb thrust. It has a swept-back wing span of 34 ft, 6 in., an overall length of 63 ft, 1 in. and is 19 ft, 8 in. from ground to top of tail surfaces. Two unusual features of the F-105 are the swept-forward air intake ducts in the plane's wing roots and a "clover leaf" type of speed brakes at the tail. Under development since 1952, an early model was first test flown in Oct. 1955 at Edwards Air Force Base, Calif. The F-105's are now in production at Republic's main plant in Farmingdale. Volume production is scheduled for 1958.

## Composite Man Who Flies His Aircraft

A survey recently completed by the Aircraft Owners and Pilots Association (65,000 members) indicates the pilot who flies for business and pleasure is quite different from the one time helmeted, local daredevil in a leather jacket who flew "by the seat of his pants."

The composite man, the survey shows is: a college man; married, and the parent of children under 21 years of age; earns \$10,906 a year; owns his own home; participates in community affairs; owns more than one and one-half automobiles; owns an airplane, or has a financial interest in one; prefers summer vacations; and he may be one of 14,525 who owns a boat.

## Aircraft Industry Faces Severe Adjustments

Some contract cancellations have already been made. Other contracts have been time extended. A large missile development was recently cancelled (North American Aviation's Navaho). It all results from two things, funds available and manned aircraft vs. missiles. According to the Aircraft Industries Association it is believed that Air Force procurement dollars will remain at about \$7 billion annually over the next few years; and so will the annual \$600 million for research and development. But, the money will be spent differently than heretofore.

Under present planning, here is what might happen over the next few years.

1. Payments for procurement of manned aircraft will drop from \$4 billion in fiscal 1956 to less than \$2 billion.
2. Missile expenditures will skyrocket from \$500 million in 1956 to about \$2.8 billion per year.
3. Engine purchases will drop from 1956's \$1.5 billion to less than a billion per year.
4. Electronic spending will nearly double, increase from \$750 million in fiscal 1956 to about \$1.3 billion.

This change in emphasis will mean new facilities for missiles, excess facilities available for manned aircraft. Bricks and mortar are a minor item compared to costly production tooling and test facilities, which will be required by the missile program.

Thinking about the status of military aircraft procurement, we

(Turn to page 118, please)



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# .. INDUSTRY STATISTICS ..

## 1957 WEEKLY U. S. MOTOR VEHICLE PRODUCTION

As reported by the Automobile Manufacturers Association

Make	Weeks Ending		Year to Date	
	July 27	July 29	1957	1956
<b>PASSENGER CAR PRODUCTION</b>				
Hudson	0	0	1,345	4,347
Nash	0	0	3,561	11,073
Rambler	1,722	2,210	57,822	50,515
Total—American Motors	1,722	2,210	62,728	65,935
Chrysler	2,030	2,097	80,750	73,972
De Soto	2,423	500	78,409	63,232
Dodge	5,778	5,248	190,834	124,791
Imperial	676	749	27,245	*
Plymouth	13,409	11,981	428,676	279,015
Total—Chrysler Corp.	24,314	20,755	805,914	541,010
Edsel	1,430	659	2,099	
Ford	29,406	30,004	929,985	808,483
Lincoln and Continental	148	924	25,900	32,725
Mercury	5,094	5,582	189,861	161,651
Total—Ford Motor Co.	36,680	37,109	1,147,818	1,000,859
Buick	7,024	6,403	257,528	355,156
Cadillac	3,370	3,389	96,499	94,988
Chevrolet	31,210	31,505	91,421	984,800
Oldsmobile	7,167	7,246	250,774	280,281
Pontiac	6,993	7,178	220,414	210,658
Total—General Motors Corp.	55,764	55,721	1,736,636	1,925,883
Packard	3	4	6,098	13,289
Studebaker	1,365	1,390	36,488	50,988
Total—Studebaker—Packard Corp.	1,368	1,394	42,586	64,277
Checker Cab	55	103	2,596	2,093
Total—Passenger Cars	119,903	117,352	3,796,278	3,600,057
* Included with Chrysler.				
<b>TRUCK PRODUCTION</b>				
Chevrolet	6,825	6,576	211,425	218,880
G. M. C.	1,402	1,447	40,119	56,942
Diamond T.	135	131	3,009	2,957
Divco	32	40	1,523	2,333
Dodge and Fargo	1,745	1,671	47,541	83,082
Ford	6,560	7,068	210,378	183,196
F. W. D.	6	42	677	1,043
International	2,933	2,803	89,942	81,898
Mack	345	353	10,001	10,880
Roe	134	134	2,512	2,225
Studebaker	244	212	6,807	9,313
White	50	299	9,002	10,825
Willys	1,679	1,090	36,500	35,811
All Others	80	80	2,562	3,906
Total—Trucks	21,769	21,956	654,086	673,191
Buses	60	80	2,540	2,614
Total—Motor Vehicles	141,732	139,388	4,454,918	4,275,862

## 1957 TRUCK TRAILER SHIPMENTS

Type of Trailer	May	April	Five Months
<b>Vans</b>			
Insulated and refrigerated	532	463	2,078
Steel	72	60	310
Aluminum	460	403	1,768
Semi-insulated	24	55	313
Steel	24	10	313
Aluminum		45	
Furniture	161	186	887
Steel	170	150	807
Aluminum	11	36	80
All other closed-top	1,647	1,473	8,630
Steel	798	731	4,280
Aluminum	849	742	4,350
Open-top	207	392	1,406
Steel	104	135	747
Aluminum	103	167	659
Total—Vans	2,591	2,479	13,314
<b>Tanks</b>			
Petroleum	443	454	2,145
All other	118	199	650
Total—Tanks	561	653	2,795
<b>Pole, pipe and logging</b>			
Single axle	31	36	180
Tandem axle	72	67	317
Total	103	103	497
<b>Platforms</b>			
Racks, livestock and stake	232	355	878
Grain bodies	132	155	721
Flats, all types	806	539	3,270
Total—Platforms	1,170	1,049	4,869
Low-bed heavy haulers	344	359	1,479
Dump trailers	256	243	1,000
All other trailers	362	315	1,488
Total—Complete Trailers	5,387	5,200	25,442
Chassis	256	258	1,315
Total—Trailers and Chassis	5,645	5,458	26,757

\*—Revised. Source—Industry Div., Bureau of the Census.

## 1957 TRUCK FACTORY SALES BY G.V.W.

As reported by the Automobile Manufacturers Association

	6,000 lb and less	6,000-10,000 lb	10,001-14,000 lb	14,001-16,000 lb	16,001-19,500 lb	19,501-26,000 lb	26,001-33,000 lb	Over 33,000 lb	Total
1st Quarter	139,575	38,996	9,157	39,434	16,509	11,533	10,296	9,085	274,587
April	46,099	16,254	3,979	19,127	7,371	4,441	3,656	3,648	105,175
May	46,425	15,600	4,701	16,497	7,624	4,442	3,408	3,615	102,312
June	43,967	13,538	3,838	15,438	6,837	4,149	2,889	3,267	94,321
2nd Quarter	137,091	45,892	12,618	51,060	21,832	13,032	9,953	10,530	301,808
6 Months—1957	278,666	84,658	21,775	90,494	38,341	24,565	20,251	19,615	578,395
6 Months—1956	238,480*	106,329*	22,285	109,858	42,353	32,760	24,672	**	596,717

\*—Prior to Jan. 1957 vehicles below 16,001 G.V.W. were grouped "5,000 & less" and "5,001-10,000 lb." \*\*—Included with 26,001-33,000 group.

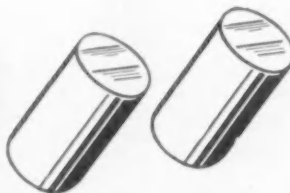
## REGIONAL SALES OF NEW PASSENGER CARS

Zone	Region	May 1957	April 1957	May 1956	Five Months		Per Cent Change		
					1957	1956	May over April	May over May 1956	Five Months 1957 over 1956
1	New England	32,645	33,879	33,099	133,565	144,761	- 3.64	- 1.37	- 7.73
2	Middle Atlantic	112,509	112,141	124,734	482,250	479,896	+ .33	- 9.80	+ .50
3	South Atlantic	74,054	65,655	70,203	331,245	321,656	+12.79	+ 5.49	+ 2.96
4	East North Central	140,482	136,651	136,853	646,857	642,756	+ 2.79	+ 2.86	+ .64
5	East South Central	26,272	27,818	25,485	124,750	131,669	- 5.56	+ 3.69	- 5.27
6	West North Central	45,906	82,161	46,575	224,140	220,986	-12.75	- 6.31	+ 1.43
7	West South Central	50,361	44,616	46,780	234,670	232,958	+12.37	+10.05	+ .73
8	Mountain	16,236	16,530	17,885	80,907	82,188	+10.32	+ 1.96	- 1.56
9	Pacific	86,277	88,958	57,720	295,448	291,852	- 4.85	- 2.50	+ 1.23
Total—United States		556,324	546,609	560,014	2,553,632	2,548,710	+ 1.41	- .06	+ .20

States comprising the various regions are: Zone 1—Conn., Me., Mass., N. H., R. I., Vt. Zone 2—N. J., N. Y., Pa. Zone 3—Del., D. of C., Fla., Ga., Md., N. C., S. C., Va., W. Va. Zone 4—Ill., Ind., Mich., Ohio, Wis. Zone 5—Ala., Ky., Miss., Tenn. Zone 6—Iowa, Kan.,

Minn., Mo., Neb., N. D., S. D. Zone 7—Ark., La., Okla., Tex. Zone 8—Ariz., Colo., Ida., Mont., Nev., N. M., Utah, Wyo. Zone 9—Cal., Ore., Wash.

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The Motch & Merryweather No. 0-4 Precision Circular Sawing Machine is automatic from the storage table to the finished cut slug. It cuts slugs accurate to  $\pm .002''$  with uniformly square ends and minimum burr. Give your cold extrusion press the opportunity of producing more work than ever before, with more accuracy than ever before, at a lower cost per piece than ever before.

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MACHINERY MANUFACTURING DIVISION  
CLEVELAND 13, OHIO

*Builders of Automatic Precision Cut-Off, Milling and Special Machinery*

# CONDUCTIVE SILICONE RUBBER

By J. H. Lorenz, M. L. Dunham and C. L. Bitner

Tonawanda Laboratories, Silicones Division  
UNION CARBIDE AND CARBON CORP.

**O**RIGINAL silicone gums were based on dimethyl groups. More recently, however, Silicones Division of Union Carbide and Carbon Corp. has developed more versatile gums. These are based on a vinyl-containing gum with "controlled reactivity" which was introduced in 1955.

With the successful development of vinyl-containing silicone gum-stocks, the next step was to develop a conductive elastomer using carbon black as a filler. This has now been done. These new and unique silicone compositions extend the scope of electrically conductive elastomeric materials to new fields.

Their electrical conductivity coupled with their retention of conductivity under stress and their good thermal stability suggest that conductive silicone rubber will be very useful in the field of flexible heaters. They are finding acceptance as heater pads on aircraft cameras and other heating units. In some applications, the non-sticking qualities of these rubbers is also an important property. De-icing boots are among the potential applications.

These rubbers are also excellent for dissipation of static electrical charges. Intricate designs of all types are possible because of their ease of processing.

The extended usefulness of the new types of silicone rubbers is based not only on the composition of the materials going into them, but the development of new vulcanizing methods, for it is in the process of curing that the chemical crosslinking of the polymers is accomplished. By the introduction of new catalysts, curing methods have been considerably simplified and speeded up, which provide a further dividend in the use of these new materials.

The ability to crosslink in the presence of carbon blacks is a result of the highly reactive nature of the vinyl groups in

these new polymers. Peroxide catalysts of much lower reactivity can be used; they are as effective as the more reactive catalysts because they are not as easily reduced by the reactive carbon black surface.

The degree of conductivity in silicone rubber can be varied by the choice and amount of loading of carbon black. Extremely low resistivities are obtained over the entire range of loadings with acetylene or battery black. At higher loadings, resistivities of 2 ohm-cm and below are easily obtained in acetylene stocks. "Philblack" A rubbers have resistivities of 5000 and 2000 ohm-cm respectively at the 30 and 40 part loadings, but above 50 parts they begin to approach the excellent conductivity obtained with the other two blacks.

All blacks can be expected to yield conductive silicone rubber at the proper loading. In addition, those blacks designed to produce conductive compositions in other media will yield the most highly conductive silicone stocks.

While any black will produce a conductive silicone elastomer, the acetylene black has the most desirable combination of properties for the practical preparation of conductive silicone rubbers. The extremely high electrical conductivity coupled with its compounding versatility makes acetylene black interesting for more extensive consideration.

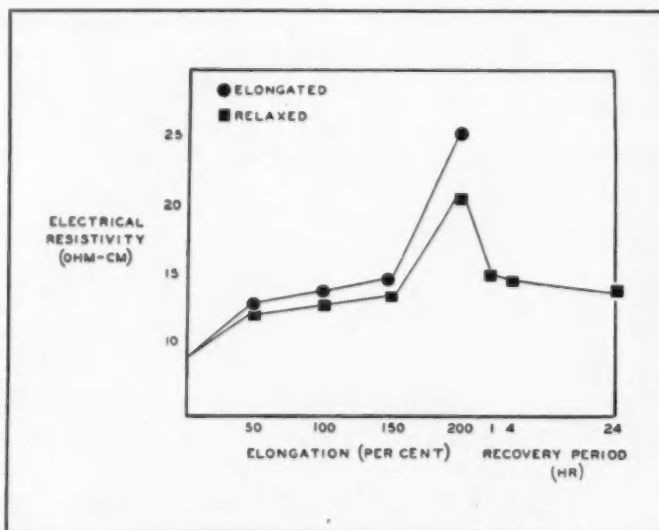
It is possible to use a mixed silica-carbon black filler system to control the electrical conductivity or processing properties of conductive silicone rubber stocks. If

(Turn to page 124, please)

## UNION CARBIDE X-1516 Effect of Stress on Electrical Resistivity

Mold Cure: 20 min. at 330°F.

Postcure: 6 hr. at 350°F.



**From the tick of a Wristwatch**



**to the roar of a Guided Missile**

*precision operation depends upon  
Hunter Douglas Aluminum Cold Forgings!*

A question frequently asked by designers is... "How small or how large a part can you economically cold forge?"

Out of thousands of Hunter Douglas production items, at one end of the scale is the tiny wristwatch bezel case. Weighing only a hundredth part of a pound, it is cold forged from high purity aluminum, complete with band attachment lugs. Wear properties are superior to gold and gold anodizing imparts a beautiful and lasting finish.

Typical of the largest pieces cold forged to date are aluminum alloy motor tubes. Hunter Douglas supplies these as prime contractors to the U. S. Navy for use in the SIDEWINDER missiles, as well as for the new "ZUNI" rocket. Some rocket tubes measure over 8 feet in length.

**SO MUCH FOR SIZE, BUT HOW ABOUT ACCURACY?** The watch case speaks for itself, but tolerances of the rocket motor tubes are even more exceptional for their size... straightness to .020" TIR, I.D.'s to  $\pm .006$ " and uniformity of wall thickness to  $\pm .0015$ ". Other tubes are produced with walls as thin as .015", some as thick as .250" or more. Typical concentricity of these is within .001" with wall tolerances of .002" and straightness in the range of .005"/ft.—in any alloy!

Between these size extremes lies a vast number of hollow components which can be economically cold forged—with almost complete elimination of, or greatly reduced, machining costs. If you require parts having superior strength, zero draft, smooth finishes and mechanical properties comparable to hot forgings you'll find an answer in Hunter Douglas Cold Forgings... now available in high strength aluminum alloys, and experimentally in oxygen-free copper, zirconium, magnesium and many steels! Ask us for recommendations.

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Division of  
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# The Solid Propellant Starter

By J. F. Webber

APPLICATION ENGINEER

Aircraft Accessory Turbine Department  
General Electric Co.

**M**ANY new problems are arising with the advancement of Aviation's jet age—and many are being solved—almost daily. Not the least of these problems is that of starting the new, larger aircraft gas turbines.

Some may say this problem is already solved, since there are many ways by which the job may be accomplished—and is actually being done every day. However, only one of today's starting systems can honestly be called "a compact, lightweight, simple, easy-to-maintain, self-contained system." This one is the solid propellant system currently used by the Air Force's Tactical Air Command on the Martin B-57 airplane. If system weight, simplicity, reliability and speed remain as leading starter criteria, it is certain that solid propellant starters will play an important role in both military and commercial aviation. Indications are that a highly refined version of this starter may well become the "optimum" system for the new, larger jets now in test cells and on drawing boards.

## Solid Propellant Starter Background

Experience with this type of starting has been good—both in the United States and in England. Consistently, the basic system has given good engine starts and has been extremely reliable. However, it now appears that long range planning was lacking considerably in its evolution—particularly in England where it was first developed. In extensive use there, it resulted in an overwhelming logistics problem when, at one point, seven different sized cartridges were kept in stock to start each of the various engines then in service. This problem, plus the relatively high cost of cartridges,

is turning the British toward other starting systems such as liquid monopropellants. They have already completely abandoned the fuel/air combustion type.

As this indicates, the early approach to the solid propellant starting system was to fit the quantity of propellant to a particular engine. Although this results in consistent starter cut-off speeds and consistent engine starts, only one size of propellant cartridge is suitable for a given model jet engine. If a cartridge intended for a heavy engine were to be used with an engine that is much easier to start, the starter turbine wheel might overspeed and cause damage to the aircraft or crew; or if a lighter cartridge were used on a heavy engine, satisfactory engine speed would not be reached and the start would be aborted.

The same basic approach—a different cartridge for each engine—is being followed here in the United States. Logistics, however, have not become a problem because of limited use of the solid propellant system. It is quite well known, though, that the potential logistics problems, coupled with the cost of solid propellant cartridges, have prevented more widespread use of this system, even though it is undoubtedly the lightest and most reliable starting system available.

Service experience with the solid propellant started on the Martin B-57 aircraft has been very good. More than 2000 of these starters are now in service, giving fast and reliable starts regularly. Since it may be started by the

pilot alone, using no external ground equipment, this medium bomber presents probably the most unique starting method of any multi-jet aircraft. A solid propellant cartridge is loaded into each starter on the J-65 engines any time prior to take-off. The pilot merely presses a button when ready to start.

## Objections to Solid Propellants

In spite of an extremely satisfactory service record, the solid propellant type of starter as it is now used seems to be popular only with the pilots and crews who use them. The primary reasons are (1) logistics, (2) cost of cartridges, and (3) black smoke emitted during the start cycle. Admittedly, these are well-founded and have served as bases for studied attempts to overcome them.

Obviously, the greatest single improvement could be made by a change in the propellant to provide a low-cost, less smoky cartridge. Equally as important, though, would be changes in the starter itself to allow the use of a single size cartridge for a group of engine models.

The first improvement—a smokeless and less expensive propellant—is now well along on its development and proof test cycle and is almost ready to be introduced into actual service.

A completely new starter is also now under development for use with a group of engines in the class of the Pratt & Whitney J-75, but which utilizes a single size of solid propellant cartridge. This "universal" cartridge will start any aircraft with a power plant in the thrust range of the J-75 and will reduce the cartridge logistics problem to a minimum.

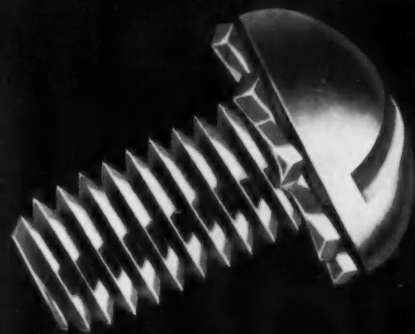
*(Turn to page 124, please)*

# Pre-assembled

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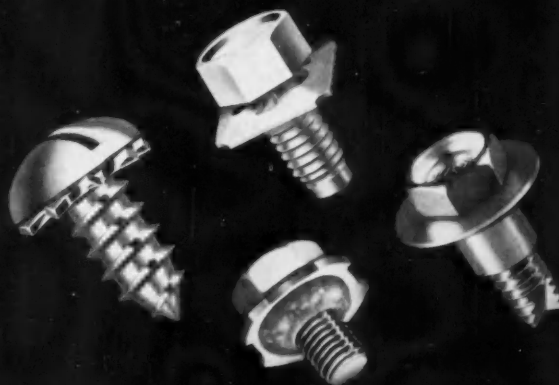
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## BUSINESS PULSE

(Continued from page 94)

In such strategic areas as automobile sales, home building, and inventory policy, no real clarification of earlier uncertainty has as yet emerged.

Toward the end of June it appeared for a while as if automobile sales might be breaking out of their sluggish pattern, but the flurry subsided in the early part of

July, the latest period covered by comprehensive reports. The performance of housing starts in June was also disappointing in the sense that there was no extension of the upturn which had been recorded, on a seasonally adjusted basis, in April and May. Instead, June starts registered a moderate decrease, and at the same time declines occurred in both applications for FHA commitments and requests for VA appraisals. While there is nothing conclusive about

this June housing experience, of course, it does mean that positive claims of revival are premature.

## Inventory Accumulation

A preliminary report by the Council of Economic Advisors on inventory investment during the second quarter of the year is also subject to unfavorable interpretation. Inventory accumulation is estimated to have taken place during the period at a seasonally adjusted annual rate of \$1½ billion. Before the publication of this estimate, it had been rather commonly assumed that businessmen in general were still reducing inventories, at least in moderate degree. The indication that they apparently were not suggests that industrial production is likely to respond less affirmatively to any increase in demand which may occur this autumn than otherwise would have been the case. If the Council's estimates for the second quarter are correct, and if even moderate accumulation continues through the third quarter of the year, business firms will be able in some part to supply increased demand out of accumulated stocks. Of course, with any really sharp and sustained increase in demand, inventories would be pared quickly in all probability, since even now inventory-to-sales ratios are not markedly unfavorable by past standards. Yet the conclusion seems inescapable that the situation which developed during the second quarter has less favorable implications than continued liquidation would have had with respect to the near-term outlook for industrial production.

## Buyers Cautious

The Council's report on consumer purchases of goods and services during the second quarter of the year reveals that caution is still widely characteristic of buying attitudes. Whereas disposable personal income is estimated to have risen by \$4.2 billion over the first-quarter rate, personal consumption expenditures rose by only a little more than \$1 billion. This means that three-quarters of the income rise (or about \$3 billion of it at an annual rate) was channeled into savings outlets. It can, of course,

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be argued that this was actually a healthy tendency, since increased



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AT *Chicago Rivet* ALL 3  
will reduce your Fastening Costs

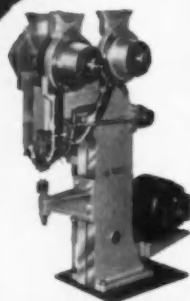


## **rivets**

**Semi-Tubular,  
Split and Shoulder**

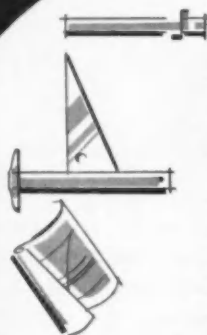


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Your fastening costs are less because Chicago Rivet makes machines that set from one to seven rivets at a time. Riveting is automatic and may involve the use of special indexing fixtures, adjustable riveting centers, and top or bottom rivet feeding and other mechanisms, controlled by solenoids or air cylinders or both.



## **engineering**

The recommendations of Chicago Rivet Engineers are most valuable. Their knowledge of rivet fastening techniques, gained from solving thousands of manufacturers' fastening problems can help make your product more competitive. Calling Chicago Rivet is a habit-formed procedure with many companies. You incur no obligation when you use the service of Chicago Rivet Engineers. Send a blue print or sample assembly with your inquiry.

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New Rivet Catalog contains engineering data, list of popular semi-tubular, full tubular, split and shoulder rivets and popular automatic rivet setters. Write for copy.

be argued that this was actually a healthy tendency, since increased savings are desirable at a time of inflationary pressures, but it does reflect consumer caution and hence hints at the existence of an obstacle that will have to be overcome if retail demand for automobiles and other items is to spurt ahead this autumn as is rather widely expected. This picture of consumer caution is borne out by the results of the latest survey of consumer attitudes conducted by the Survey Research Center of the University of Michigan. These show a weakening, by comparison with the earlier part of this year, in consumer confidence about future business conditions and a more cautious attitude with respect to purchases.

These considerations do not represent any insurmountable barrier to a revival of economic expansion this fall, but they do show that the grounds for such a revival are perhaps less strong than is sometimes assumed. In this connection it is interesting to note that the July report of the National Association of Purchasing Agents reveals a shift in the direction of greater caution. Most purchasers are reportedly still hopeful of a fall upturn, but they are not looking forward to one "with the same degree of assurance that was expressed in May and June reports." This change of view reflects unfavorable experience during the July period in both the production and new-order experience of those companies with which reporting purchasing agents are associated.

### **Few Significant Trends**

During the next month or so, most incoming statistical data will pertain to operations during the normally dull summer period, which means that for a while there is unlikely to be any significant clarification of trends. A major test will come, however, with the introduction of 1958-model automobiles. If these are received with enthusiasm—and this is possible, despite the present caution of consumer attitudes—the stimulus provided to a range of industries could tilt general activity upward again, particu-

(Turn to page 117, please)

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OF HARD SERVICE

Comparative Tests Prove . . .

## Sunvis 900 Oils have years of useful life under severe operating conditions

Versatile, long-lasting Sunvis® 900 oils are especially made to provide superior lubrication at high temperatures and in the presence of moisture. *They keep maintenance costs low.*

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For example: The 3-year-old sample above was used in an injection molding machine operated for 40-48 hours per week at temperatures between 100 and 125 F. To see how the used oil compares with its original specifications look at the following table.

Specifications	New Sunvis 916	Sunvis 916 After 3 Yr*
API gravity at 60 F	30.5-32.5	30.3
Flash, open cup, deg F, min	400	400
Fire, deg F, min	460	460
Viscosity, SUS at 100 F	150-160	173.0
Viscosity index	90	90
Neut. number	0.10	0.05
Color, ASTM	1-1.5	3.5

\*Typical Test

### HOW TO GET MORE INFORMATION

Call your Sun representative, or write for Technical Bulletin No. 35, Sun Oil Company, Philadelphia 3, Pa., Dept. I-7.

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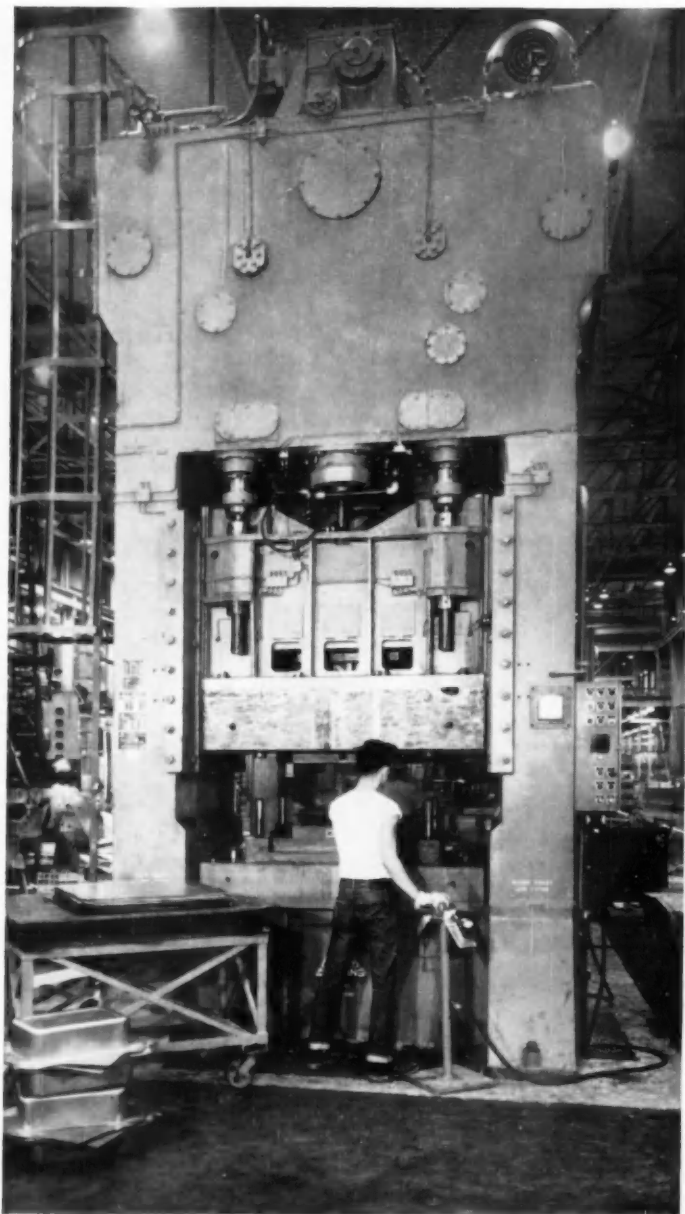


IN CANADA: SUN OIL COMPANY LIMITED, TORONTO and MONTREAL

On CARS too

"handsome is

# Westinghouse Press Control with **CYPAK** is three-ways safe... for operator, machine and work.



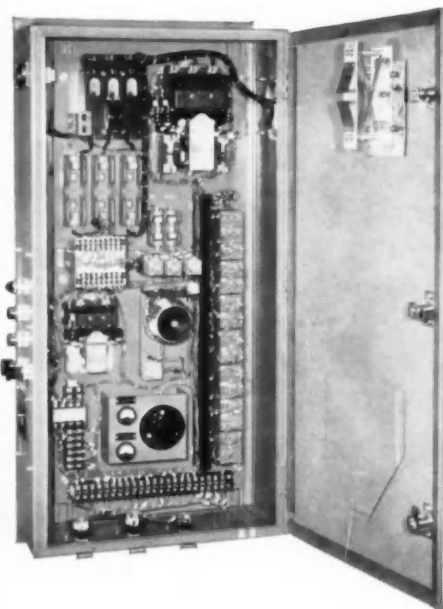
Westinghouse Press Control with CYPAK\* offers a new high in industrial safety for machine operator, the machine dies and blanks, and work material.

Because CYPAK eliminates the use of relays, there are no mechanical parts to stick or jam in the control and cause a repeat of the press. Patented anti-repeat clutch control circuit is self-checking, calling for two impulses to initiate a stroke.

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For complete information on reliably safe Westinghouse Press Control with CYPAK, call your Westinghouse Sales Engineer. Or, write Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pa.

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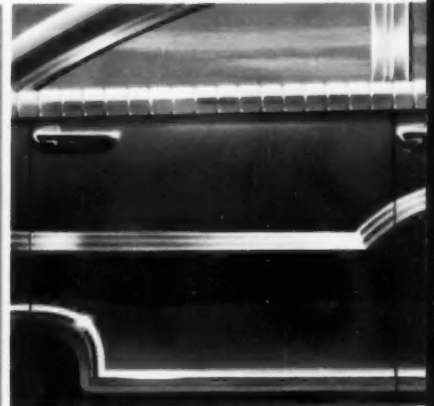


YOU CAN BE SURE...IF IT'S Westinghouse



On CARS, too... "handsome is  
as handsome does"...

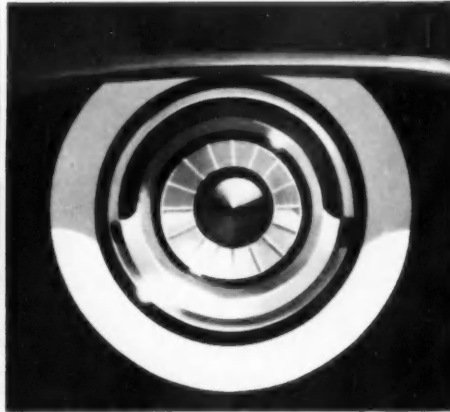
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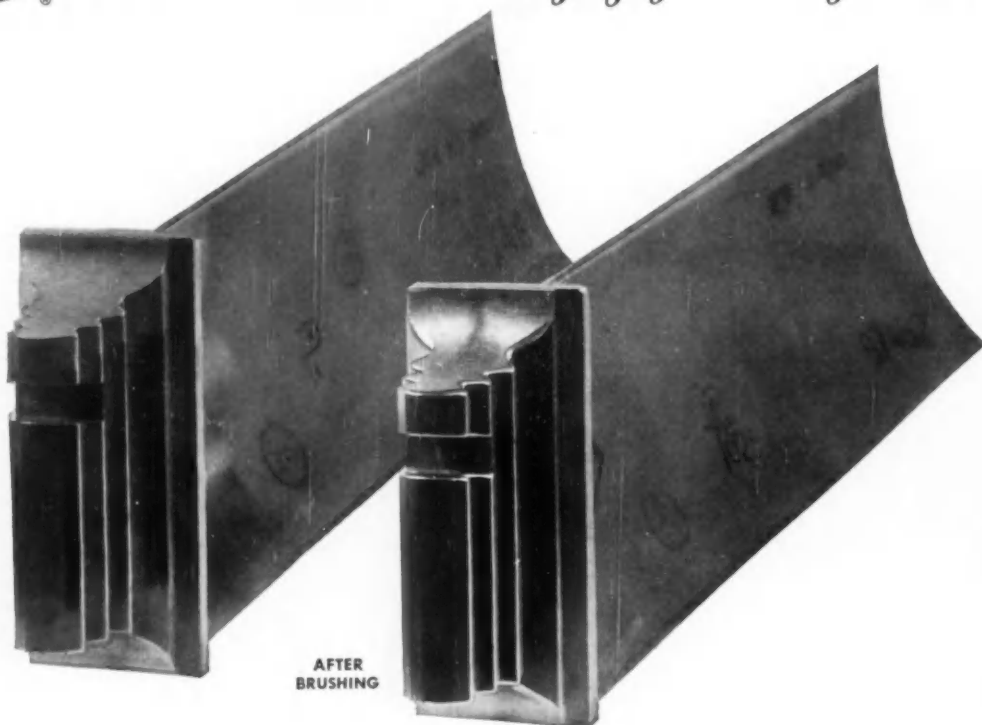
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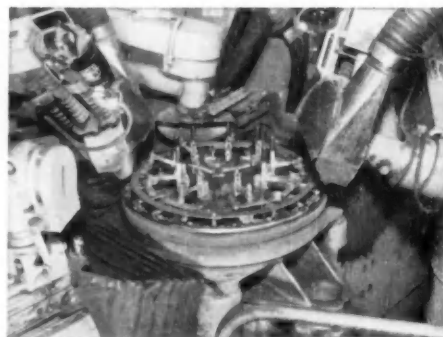
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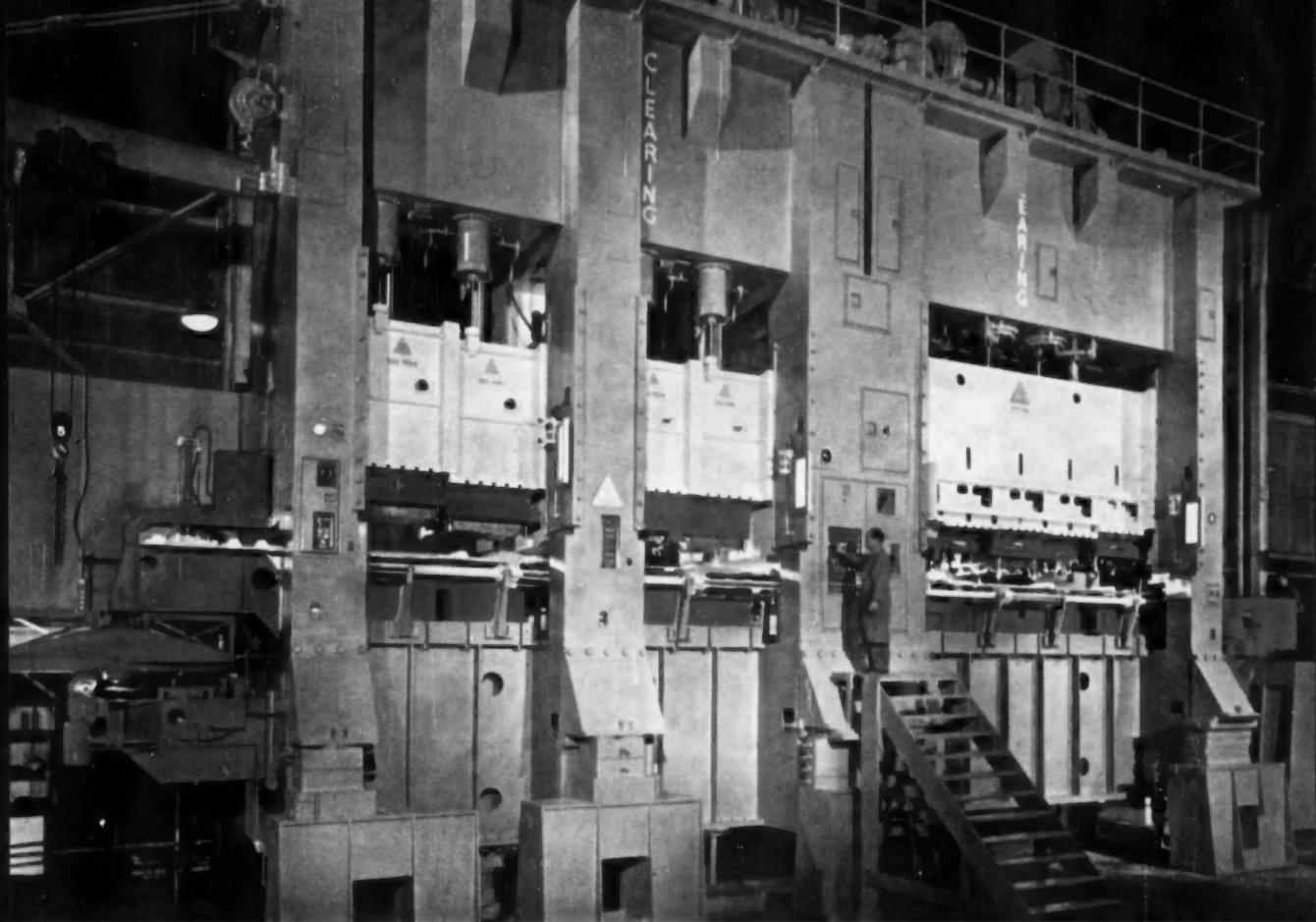


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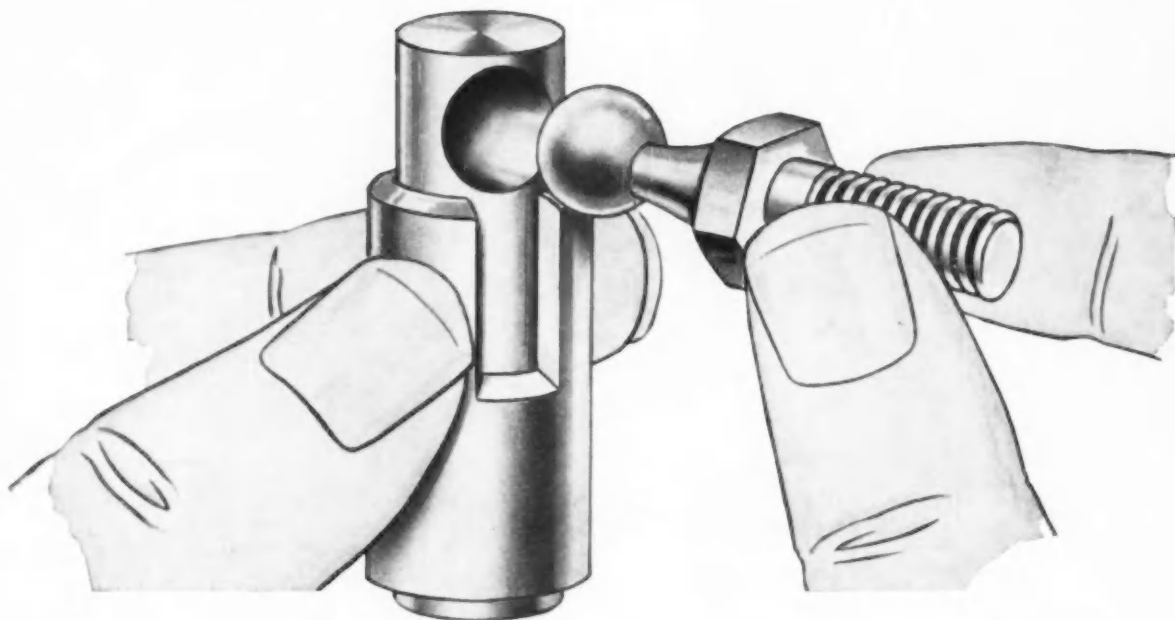
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## For Quick Assembly In Hard-To-Reach Places

### NEW TOUREK SLIP-ON BALL JOINT

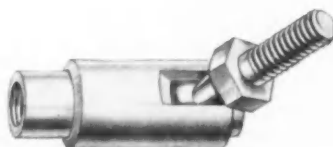
*Precision-made* for quick assembly in "hard-to-get-at places", or where adjustment of rod length must be made. Slight retraction of outer shell exposes the socket for quick insertion or withdrawal of the ball. Releasing the spring loaded shell returns it to normal operating position.

No pressure is placed on ball surface, thereby permitting free movement with approximately .004" end play. A minimum 15° movement in any direction is obtained in standard design. Side motion may be restricted for special applications.

TOUREK Slip-on Ball Joints consist of four component parts—1. Shell, 2. Outer Housing, 3. Spring, 4. Ball Screw. The shell is of rugged construction to give maximum strength in either direction. Ball screw wear surface is machined into the shell with tolerance for minimum end play. Outer housing serves three purposes: to retain Ball screw in the machined socket; to protect the spring from damage caused by exposure to foreign elements such as dirt and grease; to assure that the spring tension of the original assembly is maintained.

This design completely houses compression spring and retains the ball screw in its machined socket. Cotter pins, clips or other retaining devices are eliminated. No protruding sharp edges. No removable component parts which might become lost. Tampering with parts after assembly is minimized. A long wearing dependable assembly is assured.

This unit may also be supplied with a hardened ball screw and wear surface on shell, and prepacked with lubriplate. TOUREK Slip-on Ball Joints can presently be supplied to accommodate thread ranges from #10 to 3/8. If your applications require larger sizes or variations from standard specifications, our engineers will gladly work with you.



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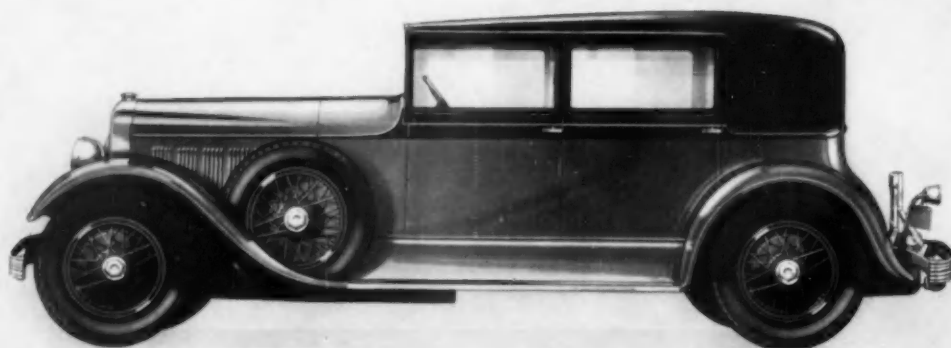


**SAVES 4 WAYS**





*They are the same ... in these two ways*



Chrysler Imperial "80"—1924

## *...engineering leadership and filtration by Purolator!*

Thirty-four years ago, that Chrysler came off the assembly line equipped with something entirely new: an oil filter. By 1956 when the Chance Vought F8U-1 Crusader shattered the national speed record, filters were accepted as basic components on all automobiles and aircraft. Both events were milestones — both vehicles were protected by Purolator.

The 1924 Chrysler seems a relic of another age, while the Crusader is as new as tomorrow. But the concept that got its start with the Chrysler has become fundamental everywhere . . . any fluid — be it air, fuel, lube oil, hydraulic fluid or anything else—which is vital to the proper operation of any aircraft, auto-

mobile or machine, must be filtered to be kept free of contamination.

Purolator makes filters for every fluid known to man—for use in any conceivable application. The unique background of specialized know-how enables them to produce the best possible filters for the specific needs of the automotive industry — no matter what they are or when they arise.

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*AUTOMOTIVE INDUSTRIES, August 15, 1957*

# **Webb Conveyors at RCA . . .**



# SAVES 4 WAYS

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This Webb conveyor installation, processing RCA Colorama TV picture tubes, is a perfect example of what can be accomplished with modern conveying techniques. In addition to the obvious economies realized with mechanized materials movement, these five conveyors, totaling 2385 feet, have provided RCA with four important benefits:

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*More Details on  
Reverse Side*



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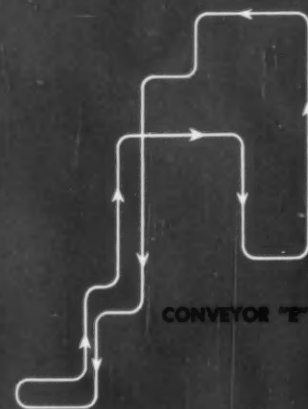
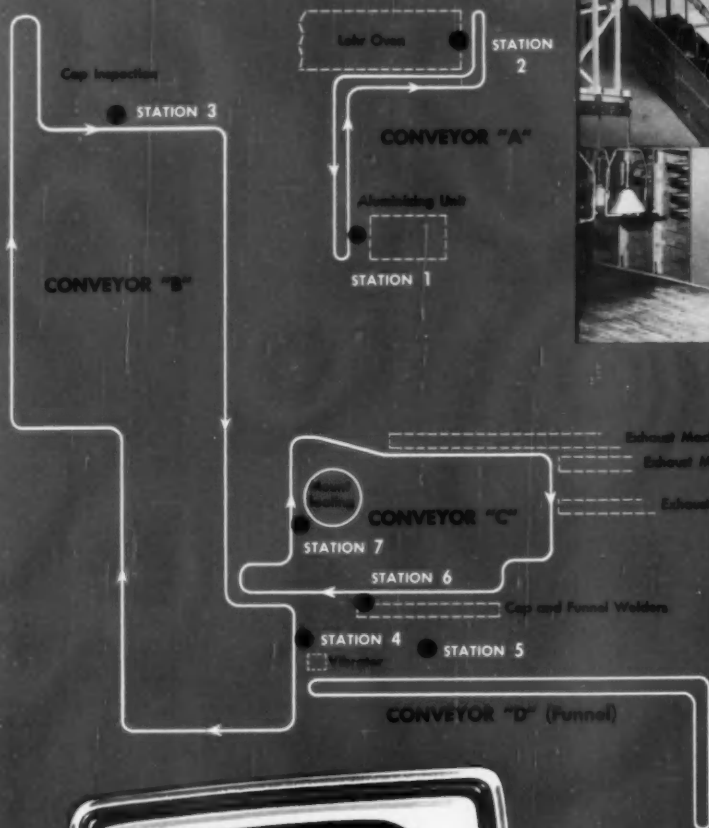
### BUSINESS PULSE

(Continued from page 106)

mensional accuracy is not as good as with investment casting. Much of the work done with this process is in the form of small parts.

*Swisher's*

## Webb Conveyors at RCA...



**a picture of  
PRODUCTION  
EFFICIENCY**

At the start of the RCA Colorama TV picture tube processing and assembly operations, the cap assemblies are taken from the aluminizing unit and placed on Webb trolley conveyor "A" at station 1. This conveyor transports the caps automatically to station 2 where they are removed and placed in a Lehr bake-out oven. After traveling through the oven, caps are inspected and placed on conveyor "B" at station 3.

The caps are then automatically carried overhead to station 4 where they are placed on a vibrator (see photo above) before being welded to funnel assemblies at station 5. Funnel assemblies are processed along the route of conveyor "D". After welding, the assemblies are placed on conveyor "C" at station 6 and carried to the mount sealing machine at station 7. This machine automatically seals the electron gun in the bulb. Several assemblies at one time rotate merry-go-round fashion in the sealing machine fixture.

Tube assemblies are again placed on conveyor "C" and con-

veyed to the straight line exhaust machines. Following the exhaust operation, tubes are banded, aged and tested. Any tubes that fail to meet the RCA quality standards are sent to salvage on conveyor "E". The salvage conveyor carries rejects through several reclaiming operations.

Throughout the RCA plant, conveyors dip down at each work station to make materials available at a convenient height and location. Between stations, conveyors automatically carry materials overhead . . . keeping aisles clear, assuring maximum productive floor area. Each of the five conveyors carry a recirculating inventory of parts, thus keeping parts storage overhead.

The Jervis B. Webb Company manufactures all types of conveyors . . . from simple straight line units to complex systems. Webb conveyors can be designed to carry all types of materials . . . from toothpicks to logs, from raw metal to 40,000 lb. tractors. Whatever your materials, a Webb conveyor can convey them . . . at lower production cost, with greater production efficiency and with more effective production control.

**If your problem is modernizing  
production flow . . . call a Webb Engineer**



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## AIRBRIEFS

which remains pumpable at temperatures ranging from  $-65^{\circ}\text{F}$  to  $400^{\circ}\text{F}$ . Electronic "black-boxes"

## BUSINESS PULSE

(Continued from page 106)

larly if the acceleration anticipated by some in highway construction also occurs. Prior to the cyclical upturn of general business which occurred in the autumn of 1954—and which was sparked by increased automobile production and sales—there were few foreshadowing signs. Thus, the absence of favorable market developments now does not rule out the possibility of a near-term generalized improvement. However, it should be recognized that there are some important differences between the present situation and that which existed in 1954. For one thing, the upturn then was preceded by a full year of substantial inventory adjustment. For another, the improvement of the automobile and housing markets at that earlier time owed much to the relative abundance of loanable funds available at comparatively low interest rates. Comparable situations do not exist in these areas today, which suggests—at the very least—that if a business upturn does occur now, it is likely to be less pronounced.

### Advancements in Investment Casting

(Continued from page 57)

coke, drag, and core. The assembled mold is preheated in another oven to about 1500-1700 F, and pouring is done in the conventional manner from a shank ladle.

This process combines the possibility of producing castings much larger than those by investment casting with the improved surface quality of the investment casting process. Up to 150 lb of metal may be poured by this method. Surface smoothness is of the order of 150-200 microinches rms, which is considerably better than that obtained with sand casting, but not as good as would be expected from investment casting. Soundness is usually better than with sand casting. Because the molds have parting lines, as with conventional molding, di-

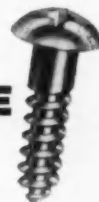
mensional accuracy is not as good as with investment casting. Much of the work done with this process is in stainless steels and low alloy steels. Among the parts cast are impeller wheels for boiler feed pumps, in 410 stainless steel, 8 in. to 15 in. in diameter, and weighing from 12 to 50 lb cleaned and snagged, or 25 to 95 lb as cast, and a turbine casing of AMS 5366 alloy, 15 in. OD, weighing 45 lb cleaned, or 85 lb as cast.

As much of the investment casting production goes into aircraft turbine work, many of the parts must be X-rayed 100% of production. For this purpose Misco has installed a million-volt X-ray unit, with a setup devised by General Electric X-ray Dept. This makes possible the examination of about 250 pieces in one exposure. The pieces are made up in racks in a given position, and in a definite order, so that a defective piece showing on any of the plates is easily identified.

High production is obtained in investment casting by use of the latest equipment. Hydraulically operated wax injection machines, automatic in operation after cycle variables have been set, fill the dies with wax to make the patterns. Injection pressure, clamping pressure, and injection temperature can be set for any given cycle, so that the operator places the die in the machine and removes it at the end of the cycle to take out the wax patterns. The new machines handle larger dies and larger volumes of wax than formerly.

Alloy flasks are fitted with paper collars at the top so that they may be completely filled without spilling over during vibrating, and may be topped off before pouring. The amount of investment slurry for each flash is measured automatically by a weighing machine as the flasks pass under it on a conveyor belt. Flasks are then passed over a vibrator, are dried in a low temperature oven, then heated in a preheating oven, which removes the wax, and go to pouring. Pouring may be done in air, in inert gas, usually argon, or in vacuum, depending upon the metal and the use to which it is to be put.

## Southern's STOCK LIST SERVICE



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## AIRBRIEFS

note from *Aviation Facts and Figures* the backlog of orders below:

(Continued from page 96)

Year	Aircraft and Parts	Engines and Parts	Propellers and Parts	Other Products and Services	Total
1949, Dec. 31	\$ 2,013	\$ 749	\$ 91	\$ 157	\$ 3,010
1953, Dec. 31	11,604	4,080	218	851	16,753
1956, Dec. 31	11,784	4,064	191	2,346	18,385
1957, Mar. 31	11,295	4,068	194	2,252	17,809

(Millions of dollars)

### Chemical Coolant-Dielectric

A special coolant with excellent dielectric characteristics has

been developed by the Organic Chemical Div. Monsanto Chemical Co. to cool airborne electronic equipment. Trademarked OS-45, it is a silicate ester-based fluid

which remains pumpable at temperatures ranging from -65 F to 400 F. Electronic "black-boxes" are cooled internally by circulating OS-45 chemical through the inside of the box. Primary use is where air-cooling is undesirable.

Monsanto and Douglas Aircraft Corp., Inc. worked jointly in developing and testing the new fluid. OS-45 has been in use and under tests during the past few years.

### Ticket Plan Improves Air Service

Policy adopted by the airlines to minimize the number of "no-shows" and make more seats available at flight time is improving air passenger service. Here is how the ticket reservation plan is working.

Since June 1, when a flight reservation is confirmed, everyone is requested to pick up his ticket at a specific time before flight departure. This is governed by how far in advance of the flight date the reservation is confirmed.

Since July 14, at stopover cities it has been necessary to reconfirm return or continuing flight reservations at least six hours before departure time.

Then, after September 15, everyone holding a flight reservation who fails to use his seat will be charged a \$3.00 penalty. This, too, will help discourage the "no-shows" and shorten the line of "standbys."

### Export of Civil Aircraft

During the first five months of 1957, total shipments of civil aircraft weighing 6000 lb or less abroad amounted to 560 aircraft valued at \$8,525,842. Total exports for civil aircraft of this class for the same period in 1956 amounted to 391 aircraft valued at \$4,464,237.

Companies reporting exports included Aero Design and Engineering Co., Beech Aircraft Corp., Cessna Aircraft Co., Piper Aircraft Corp., and Taylorcraft, Inc.

### Increase in Transatlantic Air Freight

A 42 per cent increase in scheduled transatlantic air freight traf-

# ROCKFORD MORLIFE® Over-Center CLUTCHES

Provide



## HIGH TORQUE

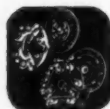
ROCKFORD Over-Center Clutches, equipped with MORLIFE clutch plates, provide 100% more torque grip than previous type clutches of equal size. This permits the use of smaller diameter clutches. Easier operation is accomplished by reducing the required engaging pressure. 50% better heat disposal avoids down-time caused by burned or warped plates. Numerous field records prove that MORLIFE clutches operate 400% longer without plate replacement or adjustment. Let these NEW type clutches help improve the operation of your heavy-duty machines.

**SEND FOR THIS HANDY BULLETIN**  
Gives dimensions, capacity tables and complete specifications. Suggests typical applications.

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Export Sales Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.

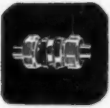
# CLUTCHES



Small  
Spring Loaded



Heavy Duty  
Spring Loaded



Oil or Dry  
Multiple Disc



Heavy Duty  
Over Center



Power  
Take-Offs

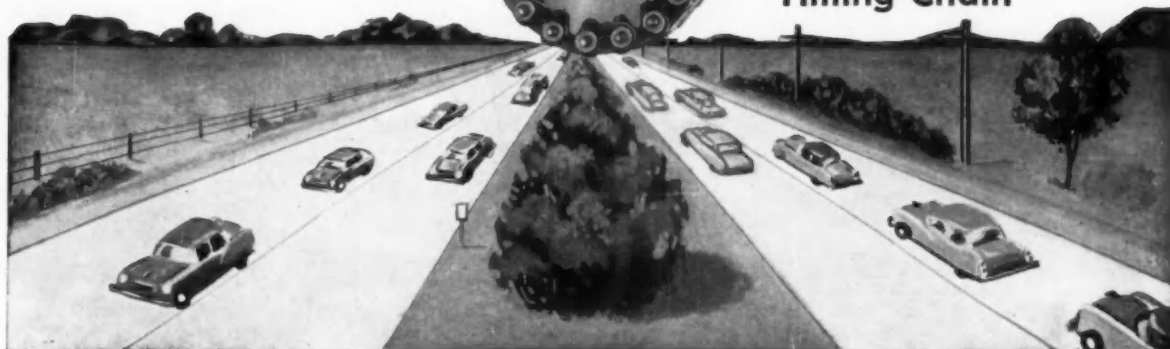


Speed  
Reducers

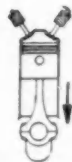
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**MORE  
MILES** of

*factory-engineered timing*

are built into  
**LINK-BELT  
Timing Chain**



*Wear compensation joint maintains  
peak performance longer*



HERE's why factory-fine valve timing lasts longer with Link-Belt Timing Chain. Adding to the benefits of segmental bushings — which automatically provide snug joints and reduce "slap" on the non-load side — Link-Belt's built-in check in joints allows forward articulation for sprocket engagement but reduces

back-bend and whip to a minimum.

In 45 years of timing chain application experience, Link-Belt has developed many "firsts" — including the space-saving  $1\frac{1}{16}$ -in. width used by major auto makers since 1949. For full details including data you need for layout work—write for Book 2065.

94-201

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**TIMING CHAIN AND SPROCKETS**

LINK-BELT COMPANY: 220 South Belmont Ave., Indianapolis 6, Ind.

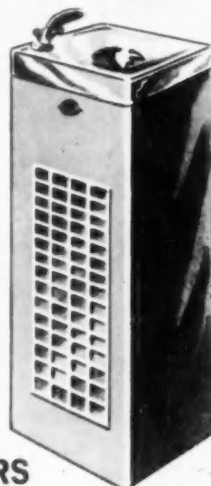
AUTOMOTIVE INDUSTRIES, August 15, 1957

119

MEMO: to PAs  
the products you buy will  
look better, last longer  
with **CrysCoat®**  
under the paint



**CALCULATORS**



**...TO COOLERS**

You're getting a better piece of equipment if it carries Oakite CrysCoat protection. It means the product has been given a paint-bonding phosphate coating before painting by the quality-conscious manufacturer. This is important to you because it means that the product is protected against the spread of rust and the peeling of paint should the finish become accidentally damaged.

Next time you purchase fans, desks, water coolers, steel lockers, lighting fixtures and similar painted equipment, investigate those with CrysCoat protection. They'll look better, last longer. For the CrysCoat story write Oakite Products, Inc., 28A Rector Street, New York 6, N. Y.



**CrysCoat paint-bonding treatment**  
makes products look better . . . last longer

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fic for the first six months of 1957 has been achieved by Seaboard & Western Airlines. Arthur V. Norden, executive vice-president, reports that his company, the only scheduled transatlantic all-cargo airline, flew 5,192,197 ton miles during the first half, compared with 3,654,232 ton miles during the comparable period of 1956.

#### **Guidance System Contract To AC Spark Plug Co.**

The Air Force has awarded a contract in the amount of \$38 million to the A. C. Spark Plug Division of General Motors Corp., of Milwaukee, Wis. The contract is for development of inertial guidance systems for the Thor intermediate range ballistic missile. Authority to commence work on the contract had been given to A. C. Spark Plug in a previously issued letter contract. The majority of the production work will be carried out in A. C. Spark Plug's Milwaukee plants, including a new plant being built exclusively for ballistic missile works in Oak Creek, Wis.

#### **Cost of a Replacement Lathe**

In 1942, when an aircraft components firm went into business, it bought a saddle-type turret lathe for one of its divisions engaged in aircraft work. The lathe then cost \$12,000. Federal tax laws permitted the firm to lay aside the original cost of \$12,000 as depreciation over a 14 year period, so presumably there would be money available to replace the lathe when it wore out.

In 1956, the lathe became obsolete. It had a resale value of \$1,000, and the company had \$12,000 to add to that with which to buy a replacement.

But the replacement cost in 1956 was \$35,000 for a lathe which would perform the same functions as the old model, or \$67,000 for a new one with attachments to meet today's more exacting needs.

In other words, this company had only \$13,000 to do a \$67,000 job. The difference of \$54,000 had to come out of profits, and in or-



## Thousands of sizes . . . available for prompt delivery

Whenever you face the problem of finding the right oil seal quickly . . . in extensive or limited quantity . . . check C/R.

More than 20 types, forming over 7,500 size combinations for shafts from 1/4" to 50" O.D. are available—the majority from stock! C/R shaft type oil seals fit most seal applications . . . from simple dust exclusion to high-speed, high temperature fluid retention under extremely rugged operating conditions where high sealing efficiency must be maintained over long service life.



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*More automobile, farm and industrial machines rely on C/R Oil Seals than any other similar sealing device.*



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Sirvene (synthetic rubber) molded pliable parts • Sirvis-Conpor mechanical leather cups, packings, boots • C/R Non-metallic Gears



der to get that amount in 1956, the company had to earn a profit of more than \$112,500 before taxes, because \$54,000 was all that remained after the Government took its corporate profit tax of 52 per cent.

To earn the \$112,500 profit, the company had to sell more than a million and a quarter dollars worth of products to customers. It took more than \$1,250,000 of sales to buy just one machine!

## General Motors Radioactivity School

(Continued from page 71)

ited fields in research, production and quality control which only properly trained men can explore. The training program also is insurance. As GM divisions uncover more and more applications for tracer, gaging, radio-chemical and other techniques, qualified specialists will be available to supervise them.

In his 10-week schooling the trainee is shown how isotopes are produced. He is instructed about supply sources, and finds out how radioactive materials are measured and monitored, how they are used today and the possible ways to use them tomorrow. He is briefed in Government regulations applying to radioactive materials, and is backgrounded in educational problems. This means keeping his management apprised of nuclear developments and also training employees under his supervision concerning the care and keep of isotopes.



## "PONY POWER" MOTORS

**that give stamina to your products**

Lamb Electric **fractional** horsepower motors, like the small horses of the famed western-pioneer-day Pony Express, are developed for **stamina**.

Their dependability, and efficiency (optimum weight-size-horsepower ratio) are qualities that result from proper design and careful manufacture by personnel with many years of experience in the small motor field.

May we demonstrate how Lamb Electric Motors can bring these advantages—and also perhaps lower costs—to **your** products?

**THE LAMB ELECTRIC COMPANY • KENT, OHIO**

A Division of American Machine and Metals, Inc.

In Canada: Lamb Electric—Division of Sangamo Company Ltd.—Leaside, Ontario

**Lamb Electric**

SPECIAL APPLICATION  
FRACTIONAL HORSEPOWER **MOTORS**



Radar voltage regulator gear motor.

A rugged high-torque, high-speed motor.

Motor with efficient spur gear speed reducer.

## MACHINERY NEWS

(Continued from page 80)

Gardner-Denver's manufacturing facilities there, has also been announced. The plant, containing about 22,000 sq ft of manufacturing and office space, is located in a new outlying industrial district of the capital city.

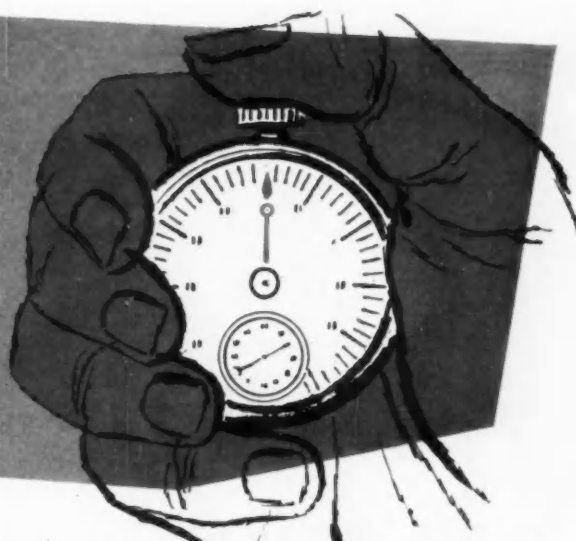
### Hydraulic Press Acquires Henry & Wright Div.

Henry & Wright Div. of Emhart Mfg. Co., Hartford, Conn., has been acquired by The Hydraulic Press Mfg. Co., a division of Koehring Co. Sources at Koehring estimate the purchase price will be in excess of \$1¼ million. Final price will be determined by the size of the inventory at the time of transfer. The move is under way and should be completed by September 1.

Henry & Wright will operate as a department of H-P-M. The H & W dieing machine, a high-speed precision mechanical press built in capacities up to 500 tons, is used in the automotive industry. The purchase makes it possible for H-P-M, a leading manufacturer of hydraulic presses, to enter the mechanical press field.

**AUTOMOTIVE INDUSTRIES  
KEEPS YOU INFORMED**

# how do you measure your production?



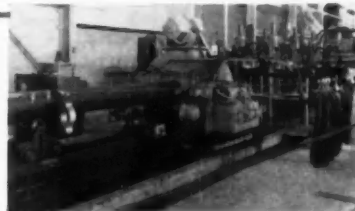
There is a *just-right* production speed for every job. Run a little faster and you'll have trouble—a little slower and your equipment is not being used efficiently. A Reliance V•S Drive will give you the *just-right* speed for each job.

Reliance V•S is an all-electric drive that operates from a-c. circuits. The operator varies the drive motor rpm. to set up the ideal speed for every job. With no rigid set of gear ratios with a limiting number of speeds, he has an infinite selection of rpm.'s from a wide flexible band of operating speeds.

There is a V•S Drive designed for your equipment. Write for Bulletin D-2311.

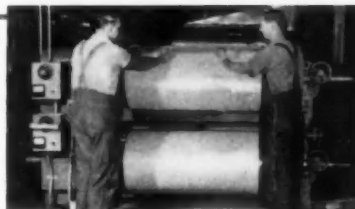
## • TONS PER HOUR — — — — —

In order to maintain a uniform production rate of 80 tons per hour with varying sizes of pipe, this pipe mill must change its line speed from 30 ft. per minute to 80 ft. per minute to compensate for differing gauges of steel. A 500 hp. multi-motor V•S Drive does the job.



## • YARDS PER MINUTE — — — — —

In order to properly size differing types of cotton cloth, the textile slasher must operate at line speeds varying from 28 yds. per minute to 225 yds. per minute. A 25 hp. V•S Drive does the job.



## • REVOLUTIONS PER MINUTE — — — — —

In order to maintain the correct tension on the metal on this highly accurate rolling mill, the speed of the coil winder must decrease from 900 rpm. to 450 rpm. as the diameter of the roll builds up. A 20 hp. V•S Drive does the job, automatically.

D-1563



# RELIANCE ELECTRIC AND ENGINEERING CO.

DEPT. 58A, CLEVELAND 17, OHIO • CANADIAN DIVISION: WELLAND, ONTARIO

Sales Offices and Distributors in Principal Cities

## CONDUCTIVE SILICONE RUBBER

(Continued from page 100)

small amounts of silica are added to an acetylene black filled stock, the handling characteristics are altered to such an extent that this method can be used to advantage when it is marginal in extrudability or calenderability. In the research laboratories it was found

that the stock had greater green strength as the silica loading was increased. These modified stocks will feed more easily to an extruder and extruded parts will hold their shape better. These stocks will also calender more easily but mold as well as the unmodified stocks.

This silica modification also produced higher strength rubbers, but brought about a relatively large increase in hardness and decrease in elongation at the 10 and 15 part silica loadings. Since the effect on resistivity is small, this is another method of

producing an entire hardness family of highly conductive rubbers.

It was also found that tensile strength and hardness increase with increasing silica content. Elongations do not fit the trend in the other physical properties. All mixer filled rubbers have lower elongations than either the silica or the black filled materials. To the best of our knowledge, this control of electrical properties is unparalleled in the field of conductive rubbers. The fabricator can design a product to meet any range of electrical conductivity.

These extremely conductive elastomers exhibit very little change in resistivity when elongated. Even at 200 per cent elongation, the elastomer is still in the realm of a highly conductive material. The recovery data indicates the permanent loss in conductivity as a result of elongation is very small.

## Solid Propellant Starter

(Continued from page 102)

### Recent Propellant Improvements

Several solid propellant manufacturers have recently been developing a new propellant based on ammonium nitrate under Air Force guidance. This practically smokeless propellant has many advantages over the presently used double-based propellant which resembles a JATO unit. It is definitely superior in the following qualities: lower cost; low smoke level; long term storage; and high temperature storage.

Ammonium nitrate, as a propellant base, is inherently much less expensive. Production quantities of this type, currently undergoing proof testing, have been estimated to cost about one-third the price of the present cartridges used in the J-65 engine.

Smoke level of the ammonium nitrate propellant has been demonstrated many times on B-57 aircraft and has been shown to be less than that caused by starting a commercial airline. This has been declared satisfactory by Air Force representatives.

The improved storage characteristics result from ammonium nitrate being inherently more



**Johnson  
TAPPETS**

Johnson Hydraulic Tappets are dependable and are of the highest quality, both in materials and in workmanship.

Johnson also makes a variety of other styles of tappets, barrel type and mushroom, of various materials, to suit the requirements of your engines.

Let us assist you in the development  
of the tappets for your new engines.

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MUSKEGON, MICHIGAN



## Vibration won't loosen FLEXLOC self-locking nuts

Where products must be reliable... must stand up under vibration, temperature extremes and hard use... designers specify rugged, reliable, precision-built FLEXLOC self-locking nuts.

### HERE'S WHY:

FLEXLOC locknuts are strong: tensile strengths far exceed accepted standards. They are uniform: carefully manufactured to assure accurate, lasting locking action. And they are reusable: repeated removal and

replacement, frequent adjustments, even rough screw threads will not affect their locking life.

Standard FLEXLOC self-locking locknuts are available in a wide range of standard sizes, types and materials to meet the most critical locknut requirements. Your local industrial distributor stocks them. Write us for complete catalog and technical data. Flexloc Locknut Division, STANDARD PRESSED STEEL CO., Jenkintown 53, Pa.

*We also manufacture precision titanium fasteners. Write for free booklet.*

**STANDARD PRESSED STEEL CO.**

**FLEXLOC** LOCKNUT DIVISION

**SPS**  
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# you can cut your GLOVE COSTS



## with the authorized **JOMAC** COST-REDUCTION PLAN

- 1 Jomac will analyze your working conditions and glove requirements
  - 2 You will receive a complete report and specific Jomac Glove recommendations
  - 3 Test and compare the Jomacs with your present gloves—and the net cost figures speak for themselves
- Your glove costs *can* be reduced. To make *profitable* use of this plan, write to Jomac Inc., Dept. H, Philadelphia 38, Pa., and say "Reduce my glove costs."

## **JOMAC** INDUSTRIAL GLOVES

Plants in Philadelphia, Pa., and Warsaw, Ind.  
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stable than present and previous compounds. This quality will prove invaluable, not only in various climates but also in the high temperature storage areas found aboard today's high speed jet aircraft.

A further promising development which has recently been demonstrated is a lowering of the flame temperature of the gases from ammonium nitrate propellant. These gases, formerly well over 2000 F, may be reduced to 1700-1800 F, or even lower. This feature will increase the longevity of the hot-gas parts of the starting system.

One ammonium nitrate base propellant has recently completed a 275 start compatibility test with a standard turbostarter. Upon inspection, the starter showed negligible wear or erosion, thus definitely indicating the feasibility of this propellant for proposed, long-life starters for the larger jet engines.

### Recent Starter Developments

Considering the inherent burning characteristics of a solid propellant cartridge (once ignited it burns completely) it is advisable, in the case of a turbine driven unit, to have an overspeed control system always waiting to go into action. With other energy sources, the hot gas supply may be shut off instantaneously by stopping the supply of fuel.

The basic design of the solid propellant starter in current use may best be described as an "open" gear box type using grease lubrication. This open-ended gear box design allows the use of a "swinging" turbine wheel which is spring loaded to move away from the hot gas jet and prevent overspeed in the event of a no-load condition. Excellent protection from overspeed is provided in this design, but hot gas from the burning propellant is allowed to enter the gear case, thus limiting the life of gears and bearings.

From this experience, it has been determined that a more optimum solid propellant turbo starter must have: a completely foolproof and automatic overspeed control;

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TODAY'S  
PRODUCTION**



**AND  
TOMORROW'S  
PLANS**

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**SHOT-PEENED**  
to make them  
up to  
**5 TIMES  
TOUGHER**

**VALUABLE BROCHURE FREE**

Shows you why U.S. Axle is your best source for precision-made special shafts.



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a sealed and oil-lubricated gear box to provide for long life and higher torques; and the ability to start a group of engines with a single size cartridge.

A starting system which will fulfill the requirements discussed above is currently under development by General Electric Co. It has pure aerodynamic speed control in which the turbine speed is limited automatically even without a load, a "fixed" wheel design with sealed, oil-lubricated gear-

ing, and a "universal" cartridge approach in which a single size of propellant grain (and thus a single size cartridge) will serve to start all the popular jet engines within a given thrust range.

The design approach to the aerodynamically, or automatically, controlled turbine wheel was such that a minimum of propellant would be required and that a safe maximum turbine speed would not be exceeded. Both of these design criteria pointed to a turbine wheel

having several rows of buckets. The unit currently under development proposes to use a universal cartridge weighing about 6½ lb to start the J-57, J-75, J-71, J-79 and other engines in this general thrust class.

Gear ratios have been designed for incorporation in a standard drive unit. These ratios are established so that in normal operation the starter turbine will see a maximum of 45,000 to 50,000 rpm. The aerodynamic feature will allow a maximum no-load speed of less than 70,000 rpm, that will be the same without a load or if the load is lost during the normal starting cycle. These are considered normal and safe speed ranges for small turbines of this type made of conventional materials. Thus, the hot gas of the burning cartridge will continue to flow through the turbine buckets, but without increasing the torque. This eliminates the danger of a wheel failure.

The complete starter, including drive unit and breech, is expected to weigh less than 40 lb.

#### Future Starter Requirements

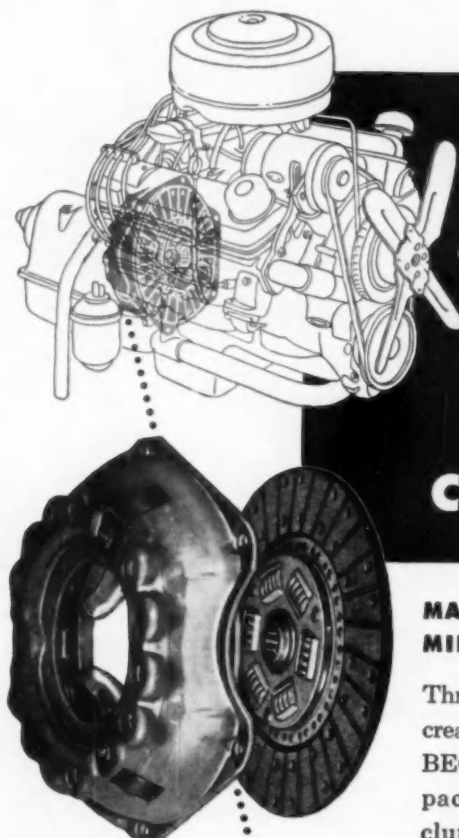
To properly evaluate new starting systems for jet engines, consideration of many important present and future criteria must be made. A listing of some of the more important requirements includes:

- (1) Self-contained system—push button starting
- (2) Minimum airborne weight
- (3) Reliability and simplicity
- (4) High temperature storage
- (5) Minimum electrical power required for starting
- (6) Minimum logistics problem
- (7) A life that matches engine life
- (8) Operation over wide temperature range
- (9) Minimum size
- (10) Low operating cost

#### Conclusions

The advanced solid propellant system described here takes into consideration the basic requirements of the "optimum" starting system.

Logistics and cost of the cartridges will probably continue to be controversial issues. However, with a cartridge that is lower



*for today's  
"power-loaded"  
engines...*

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AND  
BECK**

**CLUTCHES**

**MAXIMUM PERFORMANCE  
MINIMUM MAINTENANCE**



Through advanced design and creative engineering, BORG & BECK has stepped up the capacity of its passenger car clutches without increasing their over-all dimensions. Compact, light in weight, precision built—for maximum performance, minimum maintenance.

*for that vital spot      where power takes hold of the load*

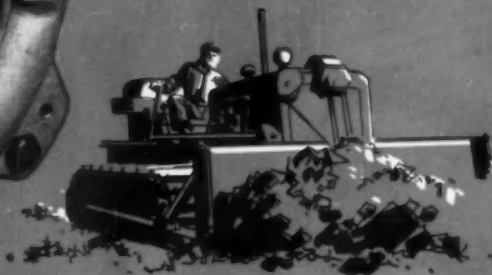
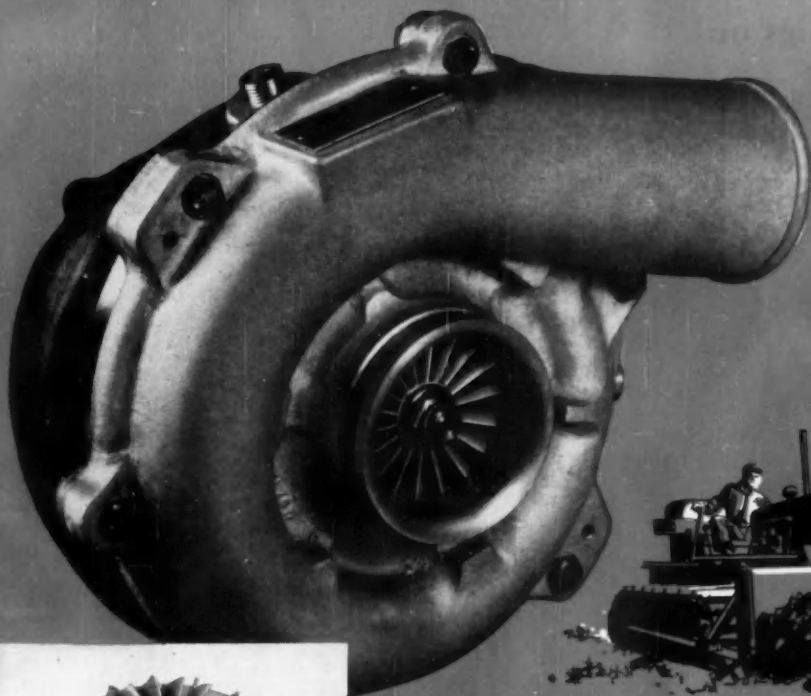
**BORG & BECK**

**DIVISION OF BORG-WARNER**

Chicago 38, Illinois

Reg. U.S. Pat. Off.



## **NEW!** Improved Vane Design Gives Thompson Turbochargers More Capacity at Lower Speeds

Only Thompson Turbochargers have simple, straight rotor vanes which provide the economy of high-pressure supercharging at low rotor speeds. This compact, simplified design is based on the Jet Division's years of experience with air- and gas-powered air compressors. Air-foil vane sections of the turbine and compressor wheels have been developed in the Jet Division lab.

In new Thompson Turbochargers you'll find many other ways in which aircraft performance has been combined with automotive simplicity and ruggedness. One-piece bearings simplify maintenance . . . rugged turbine design means longer life . . . compact, space-saving design facilitates installation.

New Thompson Turbochargers are available in sizes to efficiently blow diesels from 50 to 300 horsepower. Our engineers will welcome an opportunity to show you how Thompson Turbochargers can help you achieve up to 100% increases in horsepower, with a reduction in fuel consumption.



Write on your company letterhead for Booklet AI-257, containing detailed information on Thompson Turbochargers.



**JET DIVISION**  
**Thompson Products, Inc.**

Cleveland 17, Ohio



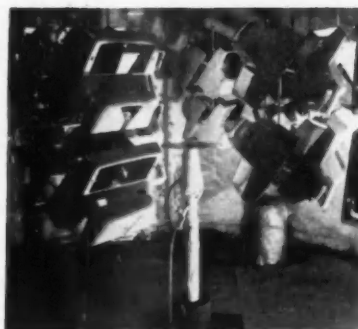


# IBM relies on RANSBURG NO. 2 PROCESS

## Electrostatic Spray Painting

to get the excellent  
and uniform high quality wrinkle finish on all

## IBM ELECTRIC TYPEWRITERS



*Both prime and finish coats are uniformly applied to IBM Electric Typewriter cases as they rotate around the floor-mounted Ransburg No. 2 Process reciprocating disks. Automatic Electro-Spray provides three times as many pieces per gallon as by former hand spray.*

IBM's strict quality standards are easily maintained with Ransburg No. 2 Process in the painting of Electric Typewriter parts. Rejects by the former hand spray method used to run as high as 30% on some parts. Now, with automatic Electro-Spray, rejects for all reasons are only 3% to 5%.

### Three Times as Many Pieces per Gallon!

Along with increased production, paint mileage is stepped up, and they get three times as many pieces per gallon as by the former hand spray method. That's because efficiency of the Ransburg No. 2 Process Reciprocating Disk puts the paint where it's supposed to go . . . on the parts.

Want to know how Ransburg Electro-Spray can improve the quality of your painted products . . . and at the same time, cut your paint and labor costs? At no obligation to you, we will make complete laboratory tests with your products to prove the advantages and cost saving benefits which can be yours with Ransburg No. 2 Process. Write or call.

**Ransburg** ELECTRO-COATING CORP.  
Indianapolis 7, Indiana

RANSBURG

priced and can be used with many engines, even these problems appear small.

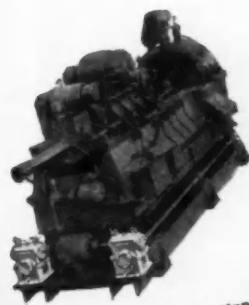
It is important to remember that the solid propellant starter described here as a 40 lb unit is a complete system. Therefore, in an objective evaluation the complete system must be considered. The cost of cartridges and the problem of cartridge supply must be weighed against the cost, complexity, maintenance and transportation problems of supporting ground equipment required for other systems. Such a consideration continues to point up the solid propellant system as one of great promise.

## BOOKS . . .

**BORON, CALCIUM, COLUMBIUM, AND ZIRCONIUM IN IRON AND STEEL**, by R. A. Grange, F. J. Shortleeve, D. C. Hilty, W. O. Binder, G. T. Motack, and C. M. Offenbauer, published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, \$14.00. The monograph series of Alloys of Iron Research is planned to present data on the effect of selected metals on carbon steel, and on simple and complex alloy steels and cast iron. The present volume in this series is a collection of four monographs on four of the elements used as alloying elements with iron and steel: boron, calcium, columbium (plus tantalum), and zirconium. Written by authorities in the field, this book summarizes all the scattered published and unpublished data on these important alloying metals.

**ENGINEERING AND DESIGN MANUAL**, published by Investment Casting Institute, 27 East Monroe St., Chicago 3, Ill. Price, \$5.00. This 50-page manual describes the investment casting process, and attempts to define its advantages and limitations. Its design section, by far the most valuable portion of the manual, contains information on surface finish, functional and general tolerances, radii, straightness, flatness, threads, airfoil, contours, etc. Other sections cover both the lost pattern and frozen mercury phases of the process, the Institute's metal specifications and test bar standards, and include a number of case histories. More than 70 illustrations, including engineering drawings, supplement the text.

**THE MACHINING AND GRINDING OF GRAY AND MODULAR (DUCTILE) CAST IRONS**, by Norman Zlatin and Charles F. Walton, published by Gray Iron Founders' Society, Inc., 930, National City—E, 6th Bldg., Cleveland, O. Price, \$3.00. This 57-page manual is intended for use in the design, engineering, and production of cast components. It is divided into two parts: the first includes chapters on selection of tool materials, grinding cutting tools, machining applications, machining properties of iron castings, economics of machining and general recommendations. The second covers types of finish grinding, honing, and lapping. Recommended practices for feeds and speeds as well as tooling are also given.



Cleveland worm gearing is standard on these fully-automatic machines which thread oil field pipe to rigid A.P.I. specifications, ranging from 1 1/4" to 13 1/2" O.D. In addition to worm gearing inside the machine, note two Cleveland Worm Gear Speed Reducers in foreground.

## On job 18 years, CLEVELAND drive is good as new

**A**FTER 18 years of continuous service in a well-known pipe mill in Pennsylvania, a Stamets pipe threading machine had its first major overhaul. When the Cleveland worm gearing was removed from the machine it looked almost like new, showed only slight traces of wear. This unretouched photograph reveals the splendid condition of both the worm and gear. In fact, the gearing is in such fine shape that it was put right back in the machine—probably good for another 18 years of strenuous pipe threading.

This example is one of thousands of Cleveland worm gear drives, many made 25 and even 30 years ago that are still in service today. They serve in every phase of American industry, drive every type of mechanical equipment where a powerful, trouble-free, right-angle drive is wanted.

For full presentation of the many types and sizes of Cleveland worm-gear drives available, write for Catalog 400. The Cleveland Worm & Gear Co., 3274 E. 80th St., Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication.  
In Canada: Peacock Brothers Limited.



# CLEVELAND

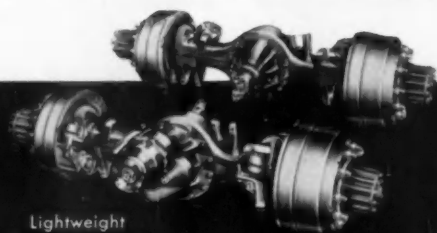
Worm Gear

*Speed Reducers*

For Today's Most Complete Line of Quality

SPECIFY...

# TIMKEN-DETROIT<sup>®</sup>



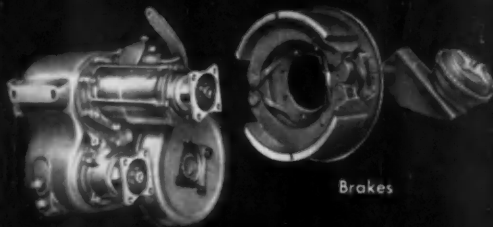
Lightweight  
Driving Tandems



Trailer Axles



Heavy-Duty  
Driving Tandems



Brakes

Gear Boxes



Single Driving Axles



Front Axles

Whether your requirements call for highway or off-the-road equipment—Timken-Detroit offers torture-tested axles and brakes proven by almost 50 years of field testing and laboratory research!

Timken-Detroit meets all your requirements for driving, trailer and front axles . . . brakes and gear boxes . . . with a complete range of capacities in each product category. Shown here are some of the units included in the complete line.

Nearly 50 years of manufacturing experience—plus continuing field and laboratory research—have taught Timken-Detroit the exacting needs of the trucking industry. Timken-Detroit Axles and Brakes are designed and built to give you the utmost in service, safety and dependability.

To you—this leadership in power transmission and braking systems means more productive road time, reduced operating costs and lower maintenance expense. Timken-Detroit Axles and Brakes are engineered to carry more payload . . . and stop more payload . . . at lower operating costs under all conditions.

The Timken-Detroit line of Medium and Heavy Duty Double-Reduction Tandems is an example of the superior engineering features and quality built into every Timken-Detroit product.

Plants at: Detroit, Michigan • Oshkosh, Wisconsin • Utica, New York  
Ashtabula, Kenton and Newark, Ohio • New Castle, Pennsylvania

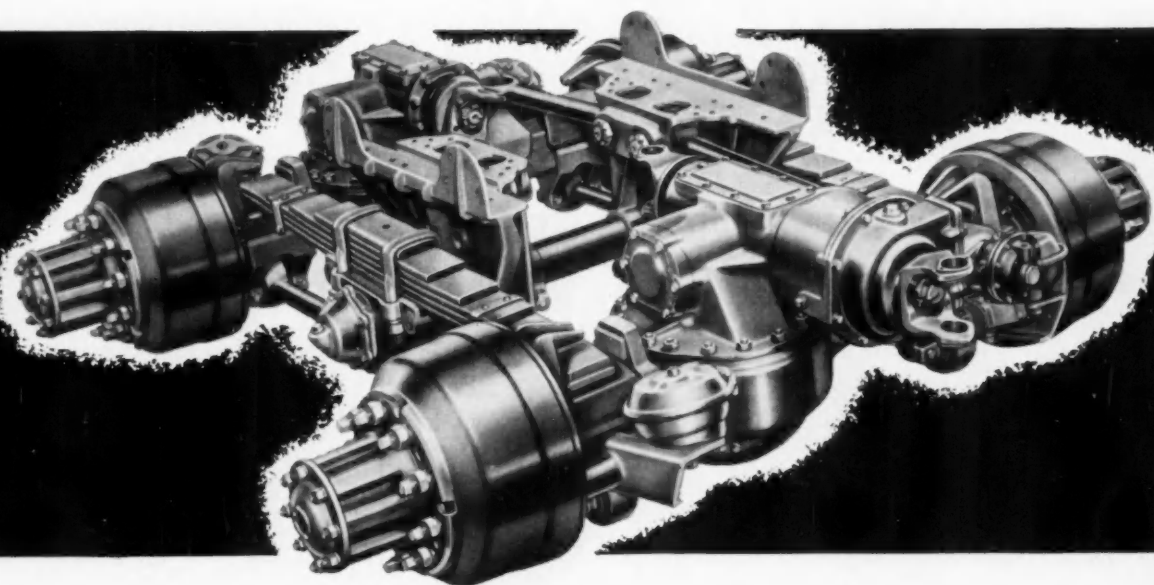
**TIMKEN**  
*Detroit*  
**AXLES**

TIMKEN-DETROIT AXLE DIVISION  
ROCKWELL SPRING AND AXLE COMPANY  
DETROIT 32, MICHIGAN



*Axles and Brakes for Commercial Vehicles*

Products  
of **Rockwell Spring and Axle Co.**



## **Timken-Detroit Heavy-Duty Double-Reduction Tandems Give You Payload Leadership!**

Ability to take the toughest going and still deliver the load on time has helped make these rugged tandems the number one choice with operators of heavy-duty vehicles. These tandems give you the big advantages of long trouble-free service, economical performance and utmost dependability.

Here are a few of the features developed in famous Timken-Detroit Tandem Drive Units—

**"Cradle Ride" Suspension**... free ends of long, resilient springs float in axle spring guide brackets. This permits axles to articulate freely, adjusting themselves to road irregularities. Floating springs cradle the vehicle, materially reducing road shock and eliminating source of vehicle flutter. "Cradle Ride" suspension

stabilizes the load, permits easy, restful driving... improves driver control and safety. Driving and braking forces are transmitted only through torque rods.

**Hypoid Gears** with their larger pinions and greater tooth contact give you outstanding performance, top efficiency and long life—plus lower maintenance costs.

**Inter-Axle Differential** divides torque evenly between axles... yet permits wheels of one axle to turn faster or slower than wheels of the other axle. This means both axles are always doing equal amounts of work. Driving parts and tires last longer. Controlled from the cab, differential can be locked out at any speed to give positive through drive.

**Rectangular Shaped Axle Housings** are forged from high carbon steel. This

rectangular shape, combined with full strength corner sections, provides the greatest strength possible with minimum weight and size.

**Famous Torsion Flow Axle Shafts** are made even stronger through the use of more splines and greater root and body diameter.

**Dependable Heavy Duty "P" Series Air Brakes** with unit-mounted design make a compact self-contained assembly. Temperatures are lower and liner life is longer because of open type spiders. Tapered "Econo-liners" provide greatest thickness in area of greatest wear.

**Unequaled parts interchangeability** gives you more time on the road—reduces parts inventory—speeds service. Parts are standard items readily available.

©1957, RS&A Company

**WORLD'S LARGEST MANUFACTURER OF AXLES FOR TRUCKS, BUSES AND TRAILERS**



## More Government Contract Awards

**L**ATEST contracts awarded by various Government agencies, and covering primarily automotive and aviation products, are listed in the following. Typical of the items contained in these monthly listings are: passenger cars, motor trucks, aircraft, military tanks, engines, transmissions, other components, spare parts, etc. This list is for the period June 26 to July 30, inclusive.

**ACF INDUSTRIES, INC.,** Erco Div., Riverdale, Md.

Trailer, bomb, turntable, type MF-10-200—\$1,715,350; cradle, bomb, type MB-7-200—\$341,068; cradle, bomb, type MB-8-50—\$22,694; technical data—\$7,924—Total \$2,087,036

**AEROIL PRODUCTS CO., INC.,** South Hackensack, N. J.

Oxygen servicing trailers—129—\$238,521

**AEROPHYSICS DEVELOPMENT CORP.,** Santa Barbara, Calif.

Design, construction, experimentation and testing of two 4-ducted aerial jeeps—\$387,831

**ALLIS-CHALMERS MFG. CO.,** West Allis, Wis.

Truck, fork lift, gasoline engine driven, 6000 lb cap.—277—\$81,204

Spare parts to support T-165 test vehicle—various—\$26,992

**AMERICAN BOSCH ARMA CORP.,** Springfield, Mass.

Actuator assembly and component parts used on J79 engine applicable to B45 and B47 aircraft—\$163,481

**ATLANTIC DIESEL MFG., INC.,** Hamburg, Pa.

Generator set, DED, 60 cycle, 30 and 100 kw—14—\$77,780

**ATLAS DROP FORGE CO.,** Lansing, Mich.

Set of experimental titanium suspension arms for the T95 tank—\$120,998

**AUTOMATIC TRANSPORTATION CO.,** Div. of Yale & Towne Mfg. Co., Chicago, Ill.

Truck, lift, fork, electric, reach type, 3000 lb cap.—\$77,390

**AVCO MFG. CORP.,** Lycoming Div., Williamsport, Pa.

Modification kits—13,827—\$66,603

**BEECH AIRCRAFT CORP.,** Wichita, Kans.

Evaluation of target drones—\$774,805

**BELL HELICOPTER CORP.,** Fort Worth, Texas

Helicopters—\$2,000,000

H-13 helicopters—\$1,679,160

**BENDIX AVIATION CORP.,** Bendix Products Div., South Bend, Ind.

Parts for carburetors—var.—\$235,617

Special tools and equipment for KC97, B47 and B52 aircraft—112—\$41,521

Pump assys. & master controls—\$1,048,391

**BOEING AIRPLANE CO.,** Industrial Products Div., Seattle, Wash.

Spare parts—13,067—\$175,747

Modification of B-52 mobile training units designated B-52-1 and B-52-2 to configuration representative to the eighty-eighth B-52 production aircraft—\$358,104

**BORG-WARNER CORP.,** Pesco Products Div., Bedford, Ohio

Parts for pumps—various—\$108,796

**BOYERTOWN AUTO BODY WORKS, INC.,** Boyertown, Pa.

Shop, mobile, set No. 4, electrical repair—85—\$1,953,725

**BUDD CO.,** Detroit, Mich.

Design and develop a wheel rim for military use—\$31,000

**CANADIAN COMMERCIAL CORP.,** Washington, D. C.

R1340-52 Engines and special support equipment—\$507,500

**CATERPILLAR TRACTOR CO.,** Peoria, Ill.

Grader, road, motorized—328—\$3,919,640

Tractor, crawler and full tracked—120—\$1,496,356

**CHAMPION SPARK PLUG CO.,** Toledo, Ohio

Igniter plug—10,350—\$28,410

**CHRYSLER CORPORATION,** Detroit, Mich.

Automotive spare parts (Modification)—\$36,361

Chassis, truck  $\frac{3}{4}$  T, 4x4—3454—\$4,038,634

Automotive spare parts—various—\$70,390

Design, develop, fabricate and test support for 6 pilot model trucks—\$1,785,044

Design, construction, experimentation and testing of two 2-ducted aerial jeep vehicles—\$661,441

**CHRYSLER MOTORS CORP.,** Washington, D. C.

Trucks—80—\$182,798

(Turn to page 136, please)



## Automatic Reminder For Motorists

### FASCO LOW OIL PRESSURE INDICATING SWITCH

The NEW FASCO "451" may be small; but . . . to the car owner, its essential protection against trouble and costly repairs is a BIG factor. And being a FASCO product, its unfailing dependability can be taken for granted. Sales-minded engineers are first to recognize its importance.

ON PUBLIC CARRIERS, the FASCO "451" also meets the need for a warning indicator of low pressure in the air-brake system. Remember . . . where dependability and economy in automotive design count, IT PAYS TO . . .



Consult  
**FASCO**  
First!



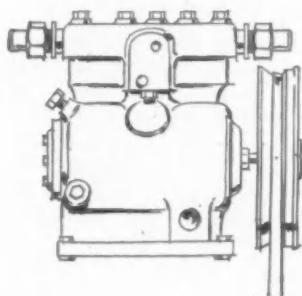
ROCHESTER 2, NEW YORK

DETROIT OFFICE—12737 PURITAN—PHONE: UN 17476

Specify Muskegon design for

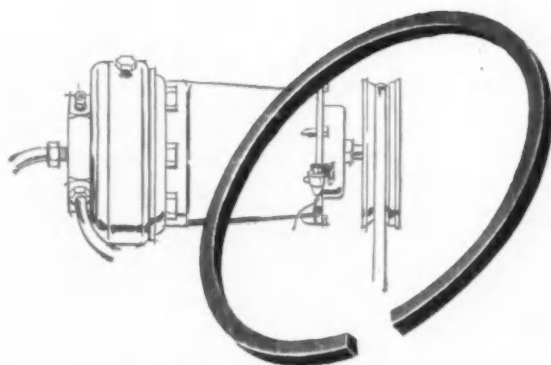
and

# '58'59



## AIR CONDITIONING COMPRESSOR RINGS

*Here's Why -*



*Since 1921... The engine builders' source!*



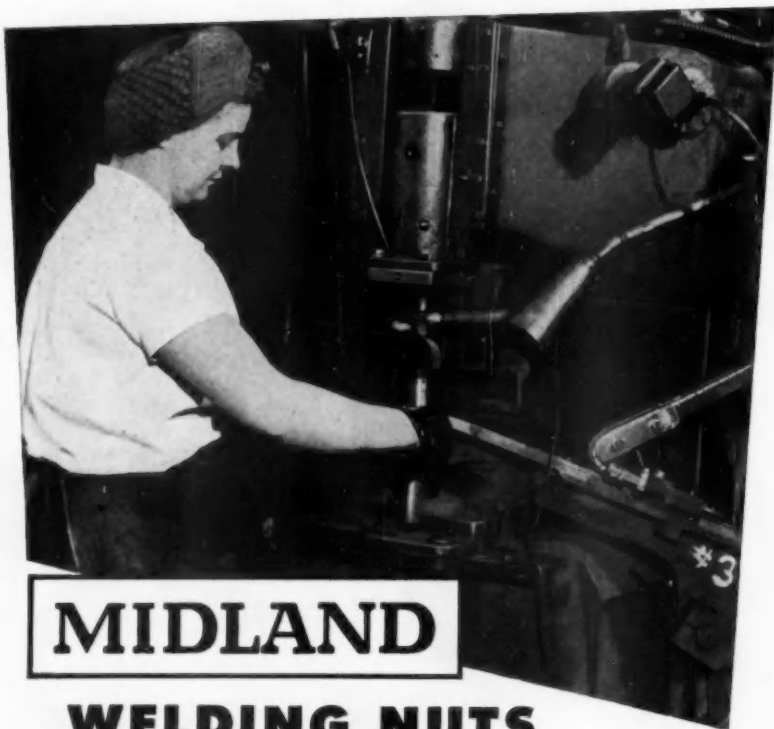
PLANTS AT  
MUSKEGON, MICHIGAN  
SPARTA, MICHIGAN  
ROTARY SEAL DIVISION  
PLANTS AT  
SPARTA, MICHIGAN  
CHICAGO, ILLINOIS

**DETROIT OFFICE:** New Center Bldg. Telephone: TRinity 2-2113

Consider these facts concerning your 1958-1959 air conditioning compressor design and development:

1. Muskegon is ready to work with you in the design and production of compressor rings—engineered to your exact requirements. You'll benefit from Muskegon metallurgical and design experience that developed many famous piston ring firsts, such as "Unitized" steel oil rings, chrome plated "Unitized" oil rings, sintered powdered metal rings and lapped chromium plated steel segments.
2. Your compressor rings will be produced in quantity, at the lowest possible cost, with the most modern manufacturing facilities. Here, highest quality rings are also manufactured for other applications, including engines, transmissions and power steering.
3. You'll receive quantity shipments when you need them, for Muskegon has the manpower, and is equipped to meet specific schedules.

It's as simple as 1-2-3 . . . Muskegon design for '58 and '59 means finer than ever air conditioning compressor units. So . . . let Muskegon plan and work with you now . . . for better design and performance in the years ahead. Muskegon Piston Ring Co., Muskegon, Michigan.



# MIDLAND

## WELDING NUTS

### Cut Assembly Time . . . Insure Proper Fit of Metal Parts

Modern designers of metal parts are finding Midland Welding Nuts a simple, low-cost means of insuring strong, bolted unions at hard-to-get-at places. Once the nut is welded into position at the exact location, the bolt can be easily turned into it without requiring a holding device on the nut. This not only means a saving in assembly time, but often results in one man being able to do a job previously requiring two.

If you're a manufacturer of metal parts, you can enhance your product appeal and at the same time pass along substantial savings to your customers if you use Midland Welding Nuts. By equipping your product with these lock-sure nuts, assembly flows uninterrupted and parts fit accurately. Welding nuts are applied in a matter of minutes, last the long life of your product.

Inquire about this economical convenience today. You'll find it pays for itself over and over again.

## The MIDLAND STEEL PRODUCTS COMPANY

5660 Mt. Elliott Avenue • Detroit 11, Michigan

Export Department: 38 Pearl St., New York, N. Y.

AUTOMOBILE and TRUCK FRAMES • AIR and VACUUM POWER BRAKES  
AIR and ELECTRO-PNEUMATIC DOOR CONTROLS

(Continued from page 134)

### CLARK EQUIPMENT CO., Benton Harbor, Mich.

Crane shovel, power unit, truck mtd., revolving, 25 ton capacity, GED, two engine, 6x6 drive, phase III, type A—6—\$261,840  
Loader, front end, with misc. equipment—9—\$118,600

### CLARK EQUIPMENT CO., Buchanan, Mich.

Truck, fork lift, gasoline driven, type IV, 6000 lb cap.—83; trucks, same except type II, 4000 lb cap.—156—\$994,429

Tractor, aircraft, towing, gasoline engine, 5000 lb drawbar pull—400—\$1,179,800

Tractor, wheeled, warehouse, gasoline powered, 4000 lb cap.—396—\$976,140

### CLEVELAND PNEUMATIC TOOL CO., Cleveland, Ohio

Actuators for ZPG-2, 2W aircraft—\$227,476

### COLES CRANE, INC., Joliet, Ill.

Crane, cruiser, wheel mounted, single engine, Diesel electric driven, 6x4, 30 ton cap—3; Boom, crane, 50 ft—3; Jib, boom 10 ft—3; Hook Block, 30 ton cap—3; total amount, \$130,269

### CONTINENTAL MOTORS CORP., Detroit, Mich.

Engine, military standard gasoline, air-cooled, model 2A016—\$1,320,960; supporting spare parts—1 lot of 19 items—\$82,239

### CONTINENTAL MOTORS CORP., Ottawa, Canada

Power pack assemblies—\$6,005,011  
750-watt engine generator sets—\$59,735

### CURTIS-WRIGHT CORP., Caldwell Wright Div., Caldwell, N. J.

Repair and rework of exhaust valves applicable to R-3350 series Aircraft Engines—4800—\$82,406

Repair and modification of propeller assemblies—\$119,857

### CURTIS-WRIGHT CORP., Wright Aeronautical Div., Woodridge, N. J.

Bearings—51,203—\$1,054,986

### DIAMOND T MOTOR CAR CO., Chicago, Ill.

Chassis, truck, 5 ton 6x6, M-139—450—\$5,599,197

### DOUGLAS AIRCRAFT CO., INC., Santa Monica, Calif.

Parts R6D spares—various—\$137,752

R5D spares—various—\$31,130

### DOUGLAS AIRCRAFT CO., INC., Tulsa, Okla.

Modification of two TB-47 type aircraft—\$81,250

### DOW CHEMICAL CO., Midland, Mich.

Services and materials to fabricate lightweight components for carrier, personnel, full track, T113—\$282,000

### ELASTIC STOP NUT CORP. OF AMERICA, Union, N. J.

Nut—1,118,000—\$166,738

### ELECTRIC AUTOLITE CO., Toledo, Ohio

Battery, storage, 12-v, 50 amp—3578—\$57,229

### EXCEL BODY CORP., Durant, Okla.

Body, truck, light maintenance, ¾ ton—307—\$96,935

### FAFNIR BEARING CO., New Britain, Conn.

Bearings—17,750—\$27,512

### FOOD MACHINERY & CHEMICAL CORP., San Jose, Calif.

Services and supplies for pilot models of the Little John vehicle chassis, suppl 2—Job—\$1,207,373

Carrier, full-tracked armored M59 W/E, without cupola, suppl 18—200—\$5,557,960

### FORD MOTOR CO., Dearborn, Mich.

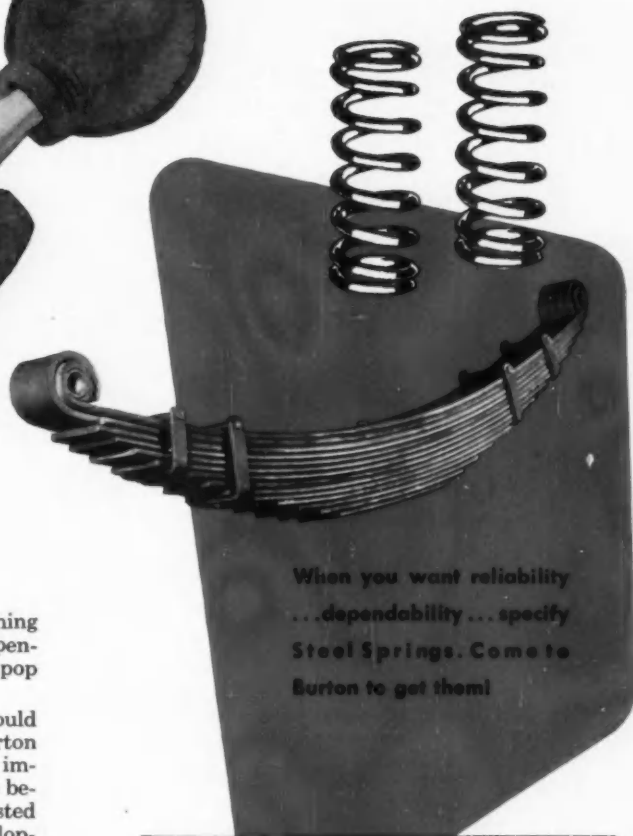
Engineering services—\$1,300,000

Spare parts for the M408, ¾ ton truck and engineering and technical assistance during test—\$389,011

(Turn to page 140, please)



# SUSPENSION *Problem?*



When you want reliability  
...dependability...specify  
Steel Springs. Come to  
Burton to get them!

Warming up a "red hot pitcher" and reaching for those wide ones can sure develop "suspension" problems. Something is bound to pop if there is a weak point.

Elimination of weak points which could cause costly failures is a specialty of Burton Spring engineers. The tortuous conditions imposed by heavy loads and high speeds are being met successfully by combining time-tested advantages of steel springs with new developments in their design and engineering. Proper load balance, controlled sidesway and rebound, positive alignment, and structural strength are achieved with today's springs by Burton.

Your suspension problems will find best solution through Burton experience in this specialized field of engineering. Your inquiry is invited.

## BURTON

**AUTO SPRING CORP.**

*Vital Support for the Automotive Industry*

**WESTERN AVENUE AT FORTY-EIGHTH STREET  
CHICAGO 32, ILLINOIS**



Trucks, buses, trailers, off-highway equipment, and private motor cars of almost every prominent make use Burton Leaf or Coil springs as original equipment.



# The New Spicer SYNCHRO-MASTER 12 TWELVE

— *newest achievement in Dana Creative Engineering*

**12" shorter, 200 pounds lighter than any other multiple-speed transmission of comparable capacity; and with sufficient low gear reduction and spread to handle various road conditions without need for auxiliary transmission or two-speed axle!**

This is a new concept of excellence in mechanical engineering design and manufacture. This is a new concept of efficiency in power transmission for heavy-duty vehicles. This is the revolutionary new Spicer Synchro-Master 12-Speed Transmission with these outstanding features:

**Blocker-type synchronizers in all speeds, forward and reverse. All six low range ratios available in reverse. Forced feed lubrication. Screen for filtering oil. Standard six-bolt S. A. E. power take-off apertures on each side. Equally spaced steps between ratios. Replaceable bearing retainer inserts in all case bores. Tower or remote control types.**

*Ask Dana engineers to help you adapt this revolutionary new Spicer Transmission to your heavy-duty truck requirements, for new standards of economy and performance.*

**DANA CORPORATION • Toledo 1, Ohio**

**DANA PRODUCTS Serve Many Fields**

**AUTOMOTIVE:** Transmissions, Universal Joints, Propeller Shafts, Axles, Power-Lok Differentials, Torque Converters, Gear Boxes, Power Take-Offs, Power Take-Off Joints, Clutches, Frames, Forgings, Stampings.

**INDUSTRIAL VEHICLES AND EQUIPMENT:** Transmissions, Universal Joints, Propeller Shafts, Axles, Gear Boxes, Clutches, Forgings, Stampings.

**AVIATION:** Universal Joints, Propeller Shafts, Axles, Gears, Forgings, Stampings.

**RAILROAD:** Transmissions, Universal Joints, Propeller Shafts, Generator Drives, Rail Car Drives, Pressed Steel Parts, Traction Motor Drives, Forgings, Stampings.

**AGRICULTURE:** Universal Joints, Propeller Shafts, Axles, Power Take-Offs, Power Take-Off Joints, Clutches, Forgings, Stampings.

**MARINE:** Universal Joints, Propeller Shafts, Gear Boxes, Forgings, Stampings.

*Many of these products manufactured in Canada by Hayes Steel Products Ltd., Merritton, Ontario*

**DANA**

**Spicer**



(Continued from page 136)

**FORD MOTOR CO.,** Washington, D. C.  
Sedans—12—\$16,856  
Trucks—248—\$445,809  
Buses, truck—3—\$12,498  
Automobiles—208—\$285,063  
Trucks & ambulances—83—\$139,085

**FOUR WHEEL DRIVE AUTO CO.,** Clintonville, Wis.  
Truck, fork lift, gasoline, pneumatic tired, rough terrain, 6000-lb cap—\$98,413

**FRUEHAUF TRAILER CO.,** Detroit, Mich.  
Services and supplies for test and evaluation of semi-trailers, refrigerator, 15 ton, 4 wheel—\$146,938  
Semi-trailer, M131A2—various—\$4,524,420  
Semi-trailers—2—\$10,408

**GALION IRON WORKS & MFG. CO.,** Galion, Ohio  
Roller, motorized, 3-wheel, 10-ton, GED, 72-in. rolling width—75—\$569,985

**GARSITE PRODUCTS INC.,** Seaford, Long Island, N. Y.  
Trailer, fuel transfer—254—\$967,596

**GAR WOOD INDUSTRIES, INC.,** Wayne, Mich.  
Crane-shovel, power unit, revolving, truck mounted, pneumatic tired, 6x6, two engine drive, 20 ton capacity, GED—295—\$10,537,703

**GENERAL ELECTRIC CO.,** Cincinnati, Ohio  
Research study of propulsion system for Army CTOL aircraft—\$275,689

**GENERAL MOTORS CORP.,** AC Spark Plug Div., Flint, Mich.  
Spark plugs—various—\$643,380

**GENERAL MOTORS CORP.,** Allison Div., Indianapolis, Ind.

Item 1 TX340 transmissions, item 2 modify TX340 transmissions, item 3 install TX360 transmissions, items 4-5 modify transmissions, items 6-7 manuals and spare parts—10, 4, 2, 1, 1, and various—\$138,560  
Vehicle and dynamometer testing of XT300 transmissions—\$95,990  
TX100 transmissions, dynamometer testing, spares—5—\$237,905  
Spare parts for XTG90 transmissions—\$27,200

**GENERAL MOTORS CORP.,** Cadillac Motor Car Div., Cleveland, Ohio  
Acceptance gages for the M42 & M56 series vehicles—\$705,000  
Gun, self-propelled, full tracked, 90mm, M56—Suppl. agreement No. 64—\$500,982

**GENERAL MOTORS CORP.,** Cadillac Motor Car Div., Detroit, Mich.  
Services and supplies necessary to accomplish the vehicle engineering agency function for vehicles of the light tank family—\$4,561,237

**GENERAL MOTORS CORP.,** Chevrolet Motor Div., Detroit, Mich.  
Truck, carry-all, ½ ton—\$29,549  
Bus, B. O. C., 29 pass. 4x2—100—\$443,621  
Trucks, pickup, ½ ton (modification)—various—\$778,242  
Trucks and buses—20—\$71,856  
Automobiles—56—\$83,725  
Automobiles, station wagons, trucks—278—\$415,407  
Trucks—411—\$477,266

**GENERAL MOTORS CORP.,** Detroit Diesel Engine Div., Detroit, Mich.  
Generator set, Diesel engine driven—34—\$685,199

**GENERAL MOTORS CORP.,** Euclid Div., Cleveland, Ohio  
Truck, dump—2—\$29,620

**GENERAL MOTORS CORP.,** Foreign Dist. Div., New York, N. Y.  
Ambulance—3—\$10,327  
Automobiles—14—\$23,010  
Trucks—31—\$45,916

**GENERAL MOTORS CORP.,** GMC Truck & Coach Div., Pontiac, Mich.  
Automotive spare parts—various—\$160,149  
Automotive spare parts (modification)—\$321,877  
Bus—2—\$11,761

**GENERAL MOTORS CORP.,** United Motors Service Div., Detroit, Mich.  
Spare—2778—\$106,026

**GENERAL TIRE AND RUBBER CO.,** Wabash, Ind.  
Bomb, leaflet, T58E3, PPTS w/fin assy., T176E1, PPTS—5000—\$1,019,900

**B. F. GOODRICH CO.,** Aviation Products Div., Akron, Ohio  
Wheel assemblies—\$85,317

**GOODYEAR AIRCRAFT CORP.,** Akron, Ohio  
Design, development, and construction of weapons system trainers, device 2F60—\$2,185,296

**GOODYEAR TIRE & RUBBER CO.,** Akron, Ohio  
Roller, material handling, rubberized, pneumatic—1485—\$252,450  
Brake assys.—152—\$47,339  
Wheel assembly for T-33 aircraft—84; brake assembly for T-33 aircraft—84; brake assembly for L-23D aircraft—36—\$40,479  
Wheel assembly for L-20 aircraft—130; wheel assembly for H-34A aircraft—147; brake assembly for H-34A aircraft—132—\$46,877  
Tire, 6.00x16, 6 PR—10,800—\$118,152  
Wheel assys. & linings—\$113,319  
Wheel & brake assys.—\$261,969

(Turn to page 142, please)



## POWER TAKE-OFF FAVORITE

Yes, a Tulsa Power Take-Off is a national favorite . . . because it offers unequalled quality in a durable, powerful, compact power take-off which runs so quietly you won't know it's working . . . except by the efficiency with which it transfers your engine power to the job. In a variety of sizes from single speed, medium duty to multiple speed heavy duty feature heat-treated cast or die-cast aluminum housings; anti-friction bearings throughout; shaved, hardened and ground gears . . . all at extremely low prices . . . and available to you through nationwide distribution and service. See your nearest Tulsa distributor for complete details and prices.





## BRIDGEPORT ALUMINUM EXTRUSIONS ADD TO THE FUN!



Selling soft ice cream is more than a matter of having plenty of vanilla and strawberry and chocolate on hand! People—even little people—are attracted to this ice-cream truck built by Glasier Truck Body Company of Newark, N.J., because it's so attractive and clean-looking.

Gleaming Aluminum Extrusions by Bridgeport help make the difference—in appearance and extra sales. Standard and special Bridgeport shapes are used in this truck, as structural members and trim . . . and their easy-to-clean, corrosion-free beauty will last for the life of the truck.

Bridgeport Extrusions were selected for this use because of their close, reliable tolerances, and their excellent finish. They are available in a complete line of standard shapes—and in any alloys you require. Special shapes can be made to meet your most exacting requirements. Whether you build ice-cream trucks . . . or massive trailer trucks, *it will pay you to get the whole Bridgeport story!* Call your nearest Bridgeport Sales Office for it.



### NEW BRIDGEPORT EXTRUSIONS BOOK

Write on your firm's letterhead for this 130-page handbook on aluminum extrusions—alloys, properties, limits, tolerances, joining, fabricating information, etc.—including full-size drawings of Bridgeport's complete line of truck and trailer shapes. Write for your copy today.



For the very newest in  
**BRIDGEPORT ALUMINUM**

Aluminum Extrusion and Forging Facilities at Adrian, Michigan  
Bridgeport Brass Company, Aluminum Division, Bridgeport 2, Connecticut • Offices in Principal Cities



**53,000 feet up ... on power by CAE**

**RYAN Q2 FIREBEE TARGET DRONE**

**J69-T-9 TURBO JET**

**J69-T-19A TURBO JET**

**MODEL 141 GAS TURBINE AIR COMPRESSOR**

**CONTINENTAL AVIATION & ENGINEERING CORPORATION**  
12700 KERCHEVAL AVENUE, DETROIT 15, MICHIGAN  
SUBSIDIARY OF CONTINENTAL MOTORS CORPORATION

**ENGINEERS!**  
There's a challenging future at CAE for qualified technicians. For full information, address: C. D. Morris, 1470 Algonquin Avenue, Detroit 15, Michigan.

(Continued from page 140)

- GRAMM TRAILER CORP.**, Lima, Ohio  
Design, develop and fabricate van, trailer pilot models, electronic, XM 288—\$81,020
- HERCULES MOTORS CORP.**, Canton, Ohio  
Concept study of a compression ignition engine—\$35,116
- HESSEE CARRIAGE CO.**, Kansas City, Mo.  
Truck, fire fighting, pumper type—\$9—\$582,238
- HOLLEY CARBURETOR CO.**, Van Dyke, Mich.  
Maintenance parts to support controls—\$231,468
- JOHN R. HOLLINGSWORTH CORP.**, Clifton Heights, Pa.  
Generator set, electric, type II, 60 kw—264—\$1,255,776
- FRANK G. HOUGH CO.**, Liberty, Ill.  
Tractors, aircraft spotting, automatic transmission, 15,000 lb cap—51—\$123,400  
Loader, front-end scoop type, ½ cubic yard—9—\$30,810
- HOWE FIRE APPARATUS CO.**, Anderson, Ind.  
Fire trucks—5—\$73,816
- HUGHES TOOL CO.**, Aircraft Div., Culver City, Calif.  
Study of cargo handling equipment for helicopters—\$44,993
- HYSTER CO.**, Portland, Oregon  
Trucks, fork lift, model MF-4 and SC180—5—\$60,109
- INGERSOLL RAND CO.**, Painted Post, N. Y.  
Compressor, air, gasoline engine driven, 3500 psi—457—\$1,668,625
- INTERNATIONAL HARVESTER CO.**, Melrose Park, Ill.  
Tractor, full tracked—532—\$9,076,680
- INTERNATIONAL HARVESTER CO.**, Washington, D. C.  
Truck, stake, 1½ ton 4x4 w/front winch—9—\$38,623  
Truck, cargo, 18,000 gvw, 4x2—111—\$390,746  
Trucks—33—\$110,664
- JERED INDUSTRIES INC.**, Hazel Park, Mich.  
Fabrication of 1 transmission—6 speed model SCS-1000—\$64,460
- JOY MFG. CO.**, Chicago, Ill.  
Compressor, reciprocating, power driven, air, 80 cfm, 5000 psi, truck mounted—40—\$867,962
- KAMAN AIRCRAFT CORP.**, Bloomfield, Conn.  
Investigation of flight characteristics of an aircraft of the cold rotor configuration—\$184,006
- KURZ & ROOT CO.**, Appleton, Wis.  
Generator set, type I, electric 45 kw, ac, DED—652—\$4,138,896; generator set, electric, portable, GED, 45 kw, type I—537—\$3,116,748
- LAMSON MOBILIFT CORP.**, Portland, Ore.  
Truck, fork lift, gasoline powered, 2000-lb cap—123—\$416,627
- LANDIS & GYR, INC.**, New York, N. Y.  
Bearings—250,000—\$50,000
- LEE RUBBER & TIRE CORP.**, Conshohocken, Pa.  
Tire, 9.00x20, 10 PR—2000—\$72,980
- LeTOURNEAU WESTINGHOUSE CO.**, Peoria, Ill.  
Grader, road, motorized—91—\$1,549,306
- LEWIS-SHEPARD PRODUCTS, INC.**, Watertown, Mass.  
Fork lift trucks—22—\$118,223
- LOCKHEED AIRCRAFT CORP.**, Marietta, Ga.  
Modification of C-130A airplane to tanker configuration for evaluation—\$139,200

(Turn to page 144, please)

## How BCA Specialization pays off for Original Equipment Manufacturers

Improved product performance and real production economies are assured when you count on BCA for ball bearings. BCA specializes in ball bearings for automotive applications—cars, trucks, buses, off-the-highway equipment . . . farm implements. This experience plus our manufacturing flexibility can serve you well. Bearings Company of America Division, Federal-Mogul-Bower Bearings, Inc., Lancaster, Pa.

*Free!* BCA "Engineering Handbook." Available to engineers without cost. Write on your company letterhead.



**BEARINGS COMPANY OF AMERICA**  
DIVISION OF  
Federal-Mogul-Bower Bearings, Inc.



(Continued from page 142)

**LYNCOACH & TRUCK CO., Oneonta,****N. Y.**

Trailers—\$116,254

Semi-trailer, van—4—\$47,246

**M-B CORP., New Holstein, Wis.**

Semi-trailer, refuse collection, 38 cu yd—5; semi-trailer, refuse collection, 32 cu yd—2—\$80,088

**MANSFIELD TIRE & RUBBER CO., Mansfield, Ohio**

Tire, 14.00x20, 20 PR, T&amp;B, M&amp;S—190—\$29,909

Tire, 10.50x18, 10 PR—1000—\$82,490

**MARLIN-ROCKWELL CORP., Jamestown, N. Y.**

Bearings—45,700—\$166,553

**MCDONNELL AIRCRAFT CORP., St. Louis, Mo.**Implementation program for F-101B aircraft—\$6,000,000  
Parts for F2H spares—\$166,242**MECHANICS UNIVERSAL JOINT, Rockford, Ill.**

Double universal joint assy.—418—\$37,323

**MICHIANA PRODUCTS CO., Michigan City, Ind.**

Tank, fuel assy. (55 gals.)—890—\$34,203

**MIDWEST ENGR. & CONSTRUCTION CO., Tulsa, Okla.**

Trailers, platform, warehouse, fifth wheel steering, 6000-lb cap—1831—\$615,618

**NORTH AMERICAN AVIATION, INC., Los Angeles, Calif.**

Preproduction work and production planning, purchase and/or mfg. long lead time materials for production of F-100D and F-100F aircraft—\$15,000,000

**OSHKOSH MOTOR TRUCK, INC., Oshkosh, Wis.**

Snowplow, displacement type—10—\$319,540

Snowplow, truck mounted, medium duty—60—\$1,679,250

**PACIFIC CAR & FOUNDRY CO., Renton, Wash.**

Modification and conversion of M53 (T97) to M55 (T108) vehicles, suppl 3—25—\$834,013

Design, develop and fabrication of T-235 and T-245 vehicles, suppl 7—\$237,088

**PETTIBONE MULLIKEN CORP., Chicago, Ill.**

Loader, front end, overhead 1½ cubic yard, DED—5—\$99,915

Loader front end, overhead, extending arms—4—\$81,572

**PIASECKI AIRCRAFT CORP., Philadelphia, Pa.**

Design, construction and testing of two (2) aerial jeep research vehicles—\$653,365

**PITMAN MFG. CO., Kansas City, Mo.**

Truck, multi-position aerial platform, 2½ ton, 4x2—2—\$31,720

**REPUBLIC AVIATION CORP., Farmingdale, N. Y.**

Production implementation for F-105C aircraft—\$2,362,000

**REPUBLIC AVIATION CORP., Mineola, N. Y.**

Advanced "short range" drone aircraft—10; ground control equipment—2; launching and recovery equipment—2—\$3,348,685

**ROSS GEAR & TOOL CO., INC., Lafayette, Ind.**

Gear, steering—1193—\$252,809

**SABRE METAL PRODUCTS, INC., Sabre Equipment Div., Lyons, Ill.**

Trailer, fire fighting, pumper type—8—\$172,336

**SHEFFIELD CORP., Dayton, Ohio**

Instrument bearing gaging equipments—\$117,766

**SOUTHERN COACH MFG. CO., INC., Evergreen, Ala.**

Bus, 4x2, 37-pass., integral—6—\$78,336

**STEWART STEEL PRODUCTS, INC., Brooklyn, N. Y.**

Chassis trailer, 1-ton capacity, type MB-1—\$214,034

**STEWART AND STEVENSON SERVICE, Houston, Tex.**

Generator set, type II, 45 kw, 400 cycle, DED—454—\$3,506,068

**O. E. SZEKELY & ASSOCIATES, INC., Commerce, Ga.**

Trailer, bomb, 12,000 lb cap, type P-3—389—\$993,393

Generator set, electric, portable, DED, 60 kw—108—\$497,743

Generator set, DED 60 cycle, 60 kw—8—\$36,869

**UNITED AIRCRAFT CORP., Hamilton Standard Div., Windsor Locks, Conn.**

Design a 3-blade propeller—\$169,070

**UNITED AIRCRAFT CORP., Pratt & Whitney Aircraft Div., Palm Beach County, Fla.**

Acquisition, rehabilitation and installation of machine tools and capital equipment in plant—\$27,971,390

**UNITED AIRCRAFT CORP., Sikorsky Aircraft Div., Stratford, Conn.**

H-19D helicopters—\$896,000

H-37A helicopter—\$16,000,000

(Turn to page 148, please)



**Exclusive  
BONDED-LEAD  
CONSTRUCTION**

**Makes Vision-Aid The Most  
Rugged Passenger Car  
Headlamp Ever Built!**

New standards of lighting dependability are created by the new Tung-Sol Vision-Aid Headlamp. A spot-weld bond, an exclusive Tung-Sol feature, joins two lead wires inside the reflector of the headlamp. Result: a more stable filament assembly that is far less affected by shock and vibration.

Exhaustive laboratory impact tests clearly reveal that these new headlamps stand up under more service abuse than any other headlamp on the market.

Tung-Sol Headlamps conform fully to industry standards: E-Z Aim

Platforms provide quicker, simpler aiming and the improved passing beam which gives up to 80 extra feet of seeing distance make Tung-Sol Vision-Aid Headlamps the finest for both 6 and 12-volt service. You can provide no better illumination for your line of automobiles.

The Vision-Aid 5440-S Headlamp for truck and bus service includes the spot-welded leads, E-Z Aim Platforms and the longer range passing beam as well as re-proportioned filaments, ceramic ruggedizing collar and anti-shock fog cap mounting.



**TUNG-SOL®**

**VISION-AID HEADLAMPS**

5040-S 6-VOLTS 5400-S 12-VOLTS

Tung-Sol Electric Inc., Newark 4, New Jersey

Sales Offices: Atlanta, Ga.; Columbus, Ohio; Culver City, Calif.; Dallas, Tex.; Denver, Colo.; Detroit, Mich.; Melrose Park, Ill.; Irvington, N. J.; Newark, N. J.; Philadelphia, Pa.; Seattle, Wash. Canada: Montreal, P.Q.

# "...an all-round solution to the problem of removing scale from sheets"

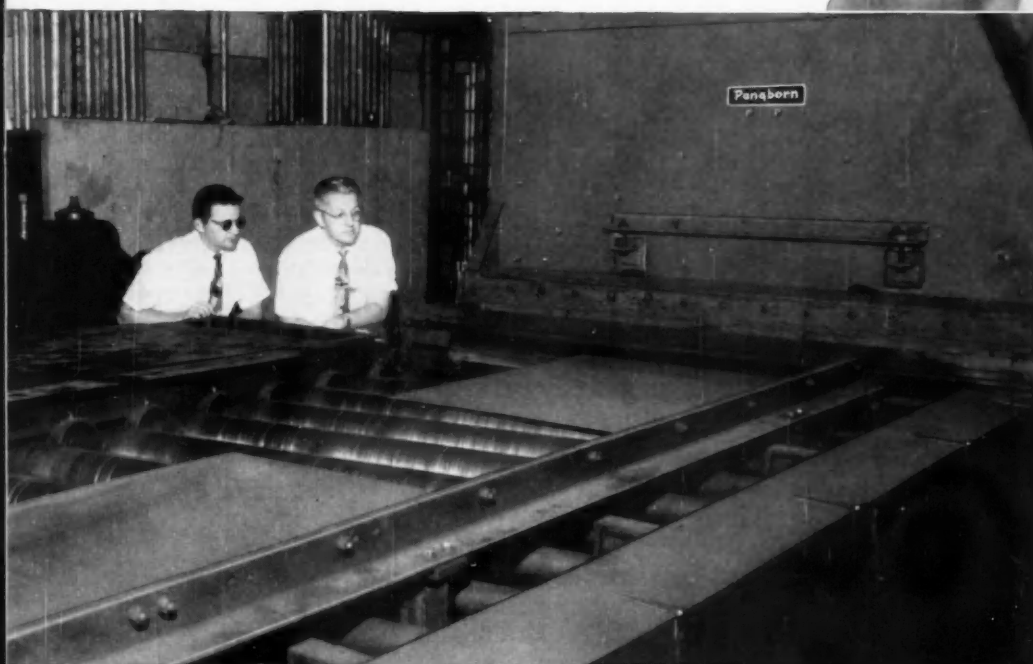
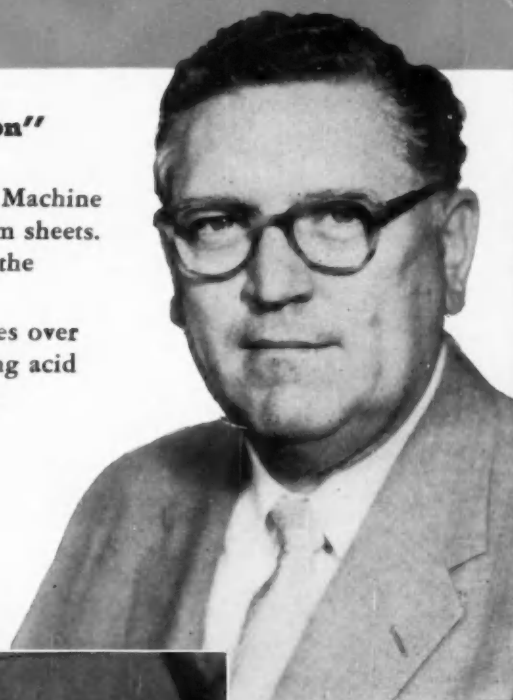
says T. A. SULLIVAN, Plant Manager,  
Granite City, Ill. Works, A. O. Smith Corporation

## "Extremely pleased with high volume of production" of PANGBORN DESCALING MACHINE

"In many ways," says Mr. Sullivan, "the Pangborn Descaling Machine is an all-round solution to the problem of removing scale from sheets. We're extremely pleased with the high volume of production the machine is handling . . . it's fast and thorough."

And A. O. Smith management rates the following advantages over pickling equally important: conserving floor space—eliminating acid disposal problems and hazards to employees—better working conditions and plant housekeeping—more fully automated plant that saves time and labor.

If you're descaling sheets, plates, coils and rods, write today for Bulletin 608, PANGBORN CORP., 3900 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Blast Cleaning & Dust Control Equipment.*



At A. O. Smith, sheets descaled on this Pangborn Descaling Machine draw easily, weld readily . . . and the fine matte surface takes a permanent bond.

# Pangborn ROTOBLAST®

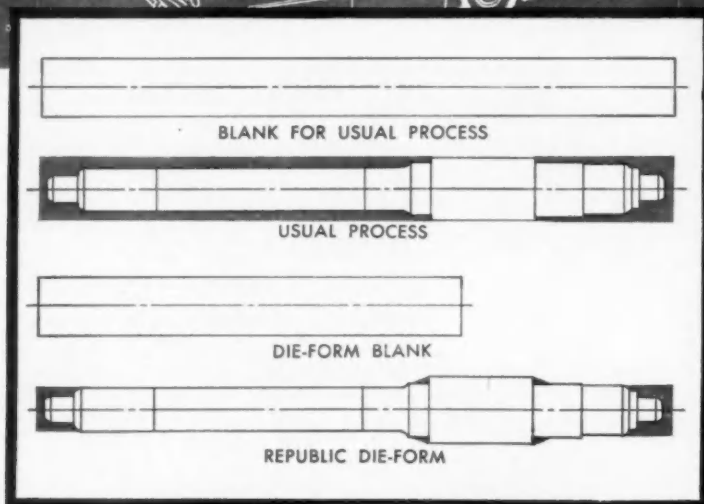
**cleans cheaper**





**YOU CAN SAVE UP TO  
1 OUT OF 3 TONS OF STEEL**

when you specify Republic Die-Form for high-volume production of multi-diameter machine shafts. Drawings and photographs show dramatic savings actually made possible in an automotive transmission shaft. In this case, 200 tons of cold formed blanks produced parts formerly requiring 300 tons. Machining time was reduced accordingly.



# REPUBLIC



*World's Widest Range of Standard Steels*

# REPUBLIC DIE-FORM

**What It Is.** The Republic Die-Form process is a new method of cold forming hot rolled carbon, alloy, or stainless steel bars into multi-diameter bars ready for final finishing.

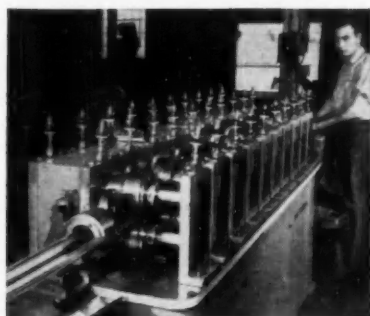
**What It Does.** Use of Republic Die-Form instead of conventional bar stock permits major savings in time, steel, and money in mass produced, multi-diameter machine shafts. Since Die-Form closely approximates the final part, only finishing cuts and/or grinding are required for completion. Scrap loss is minimized—production rate increased.

Savings in time and steel mean dollar savings. However, costs may be further reduced through decreased capital investment in machine tools, and elimination of excess weight-handling costs in raw material and scrap disposal.

Finally, Republic Die-Form processing increases tensile strength and machinability of any given hot rolled steel analysis used. These characteristics assure an outstanding surface on completed parts, provide further reductions in machining time and permit the possibility of heat treatment elimination.

**Capacity and Limitations.** Republic Die-Form is available up to two inches in diameter. It is limited to symmetrical cross sections of two or more diameters. "Hourglass" sections cannot be produced. Die-Form is economical only in large production runs.

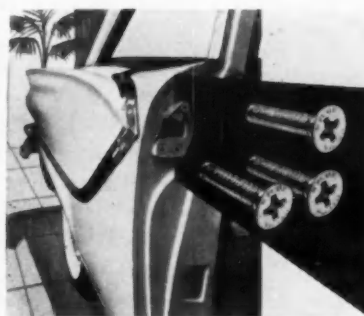
Plan now to check the savings potential of Republic Die-Form in your machined shaft production. Contact your Republic office for full details. Or write for illustrated literature, ADV-746.



**SAVE PAINT PREPARATION COSTS** on your formed steel products by specifying Republic Electro Paintlok®. Special paint-holding surface is applied at our mills. It won't crack, flake or peel, even under severe bending, as demonstrated by this acoustical fastener forming operation. Final finish can be applied immediately, with excellent results. Mail coupon for data.



**TIME, LABOR, AND SPACE SAVINGS** were all realized through use of Republic Roll-Over Boxes for this bulk chemical handling operation. Former laborious methods involving bagged material were eliminated. Now one man with revolving-fork truck does the job faster, more efficiently. Check advantages of Republic's complete materials handling line. Send coupon.



**LIFESAVING DOOR LATCH** striker plate is permanently anchored to door post with Republic Nylok® Bolts. Nylon pellet in body of bolt forces strong metal-to-metal lock between opposite mating threads. Resiliency of pellet provides excellent adjustability and re-use characteristics—and provides liquid seal when bolts are seated. Send coupon for facts.

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*and Steel Products*

## REPUBLIC STEEL CORPORATION

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☐ Please send me Republic Die-Form Folder, ADV-746.

Please send me more information on:

- ☐ Nylok Bolts    ☐ Materials Handling Equipment  
☐ Electro Paintlok Sheets

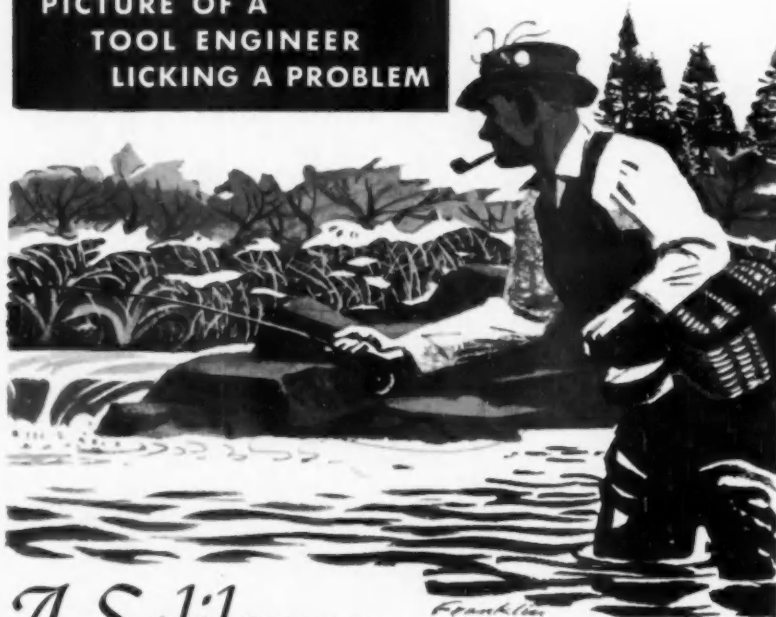
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Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

# PICTURE OF A TOOL ENGINEER LICKING A PROBLEM



## A Soliloquy:

"Lucky I switched to 921-T on that Friday project, or I wouldn't be out here whipping this stream today.

Funny, how that one material met all the problems; maximum stability, easy machinability, light weight — everything the old man wanted, and at less cost.

"I can see where 921-T could be used on every job on the board, and maybe a few that haven't been dreamed up yet. Come Monday, I'll recommend to Purchasing that we put in a stock of Pioneer 921-T and standardize on it for everything. It saws, taps, mills and welds so easily, a lot of material waste could be avoided. Boy . . . that's one for the suggestion box."

Pioneer 921-T cast aluminum tooling plate is a worry antidote for tool engineers. To get the complete story of its universal adaptability to form blocks, stretch form dies and jig components of all kinds, call your nearest Pioneer distributor for a copy of the new 921-T brochure.

ALBUQUERQUE, N.M.: Morris Steel & Supply Co.  
ATLANTA, GA.: Southern States Iron Roofing Co.  
BOSTON, MASS.: American Steel & Aluminum Corp.  
                    Joseph T. Ryerson & Son, Inc.  
BIRMINGHAM, ALA.: Southern States Iron Roofing Co.  
CHICAGO, ILL.: Joseph T. Ryerson & Son, Inc.  
CLEVELAND, OH.: Kasle Steel Corporation  
DALLAS, TEX.: Vinson Steel & Aluminum Co.  
DEARBORN, MICH.: Pioneer Aluminum Inc.  
DENVER, COLO.: ABC Metals Corporation  
DETROIT, MICH.: Kasle Steel Corporation  
                    Meier Brass & Aluminum Co.  
GRAND RAPIDS, MICH.: Kasle Steel Corporation  
HARTFORD, CONN.: American Steel & Aluminum Corp.  
RILLSIDE, N.J.: Edgcomb Steel & Aluminum Corp.  
HOUSTON, TEX.: Vinson Steel & Aluminum Co.  
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KANSAS CITY, MO.: Industrial Metals, Inc.  
LOS ANGELES, CALIF.: Bralco Metals, Inc.  
LOUISVILLE, KY.: Southern States Iron Roofing Co.  
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NASHVILLE, TENN.: Southern States Iron Roofing Co.

OAKLAND, CALIF.: Earle M. Jorgenson Co.  
RALEIGH, N.C.: Southern States Iron Roofing Co.  
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### EASTERN SALES OFFICE:

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Richard G. Evans, Mgr.  
23439 Michigan Ave., Dearborn, Mich.

### SOUTHWEST REGIONAL SALES MANAGER:

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**PIONEER ALUMINUM INC.**

Subsidiary of MORRIS P. KIRK & SON, INC.

PACIFIC COAST UNIT OF NATIONAL LEAD COMPANY

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TOOLING PLATE  
HEATING  
PLATES  
VACUUM CHUCKS  
EXTRUSIONS

(Continued from page 144)

U. S. RUBBER CO., Fisk Tires Div., Detroit, Mich.

Tire, 6.00x16, 6 PR—\$11,500—\$123,625  
Tire, 9.00x16, 8 PR, T&B, M&S—\$1000—\$30,610

UNITED STATES MOTORS CORP., Oshkosh, Wis.

Generator set, DED, 60 cycle, 15 kw—400—\$1,366,822

UTICA BEND CORP., Utica, Mich.

Mercedes-Benz supercharged engines—\$114,990

VERTOL AIRCRAFT CORP., Morton, Pa.

Parts for HUP spares—various—\$868,451

VICKERS INC., Detroit, Mich.

Pump and motor assys.—various—\$209,910

Hydraulic motors—75—\$28,218

Maintenance parts for pumps—\$151,408

WAGNER ELECTRIC CORP., St. Louis, Mo.

Shoe assy., w/lining assy.—42,452—\$153,930

WALTER MOTOR TRUCK CO., Ridge-wood, Queens, N. Y.

Snowplow, truck mounted—11—\$197,901

WARD LaFRANCE TRUCK CORP., Elmira Heights, N. Y.

Type MB-2 aircraft towing tractor—\$3,670,465

WATSON AUTOMOTIVE EQUIPMENT CO., Washington, D. C.

Ambulances—2—\$14,286

WAUKESHA MOTOR CO., Waukesha, Wis.

Gasoline generator set, rubber tired wheel mtd.—136—\$211,579

WHITE MOTOR CO., White Diesel Engine Div., Springfield, Ohio

Generator set, DED, 250 kw—2; swing panel—1—\$57,264

WILLIS MOTORS, INC., Toledo, Ohio

Light weapons, infantry, ½ ton 4x4, M274—\$609,759

Vehicle engineering agency service for carrier, light weapons, infantry 1½ ton 4x4, M274—\$309,419

Prototype truck, utility, ¾ ton 4x4—\$50,000

Fire engine—11—\$43,688

Trucks—39—\$102,579

Design and fabricate one experimental model of a carrier, lightweight convertible, ¼ ton, 4x4, vehicle—\$72,063

Spare parts, for carrier light weapons, infantry, ½ ton 4x4, M274, suppl. agreement No. 18—\$88,638

Cover, top assembly, w/rear window, for truck ¾ ton 4x4—\$50,755

WINPOWER MFG. CO., Newton, Ia.

Generator set, gasoline engine, 1.5 kw, type II—3631—\$1,108,912

WORTHINGTON CORP., Chicago, Ill.

Compressor, air, reciprocating, GED, trailer mounted, 2-wheel, pneumatic tires, 55 cfm, 80 psi—100—\$206,326

YALE & TOWNE MFG. CO., Philadelphia, Pa.

Truck, fork lift, gasoline driven, 15,000 lb cap—53—\$486,226

Truck, lift, projectile handling, electric, 4000 lb cap—6—\$45,276

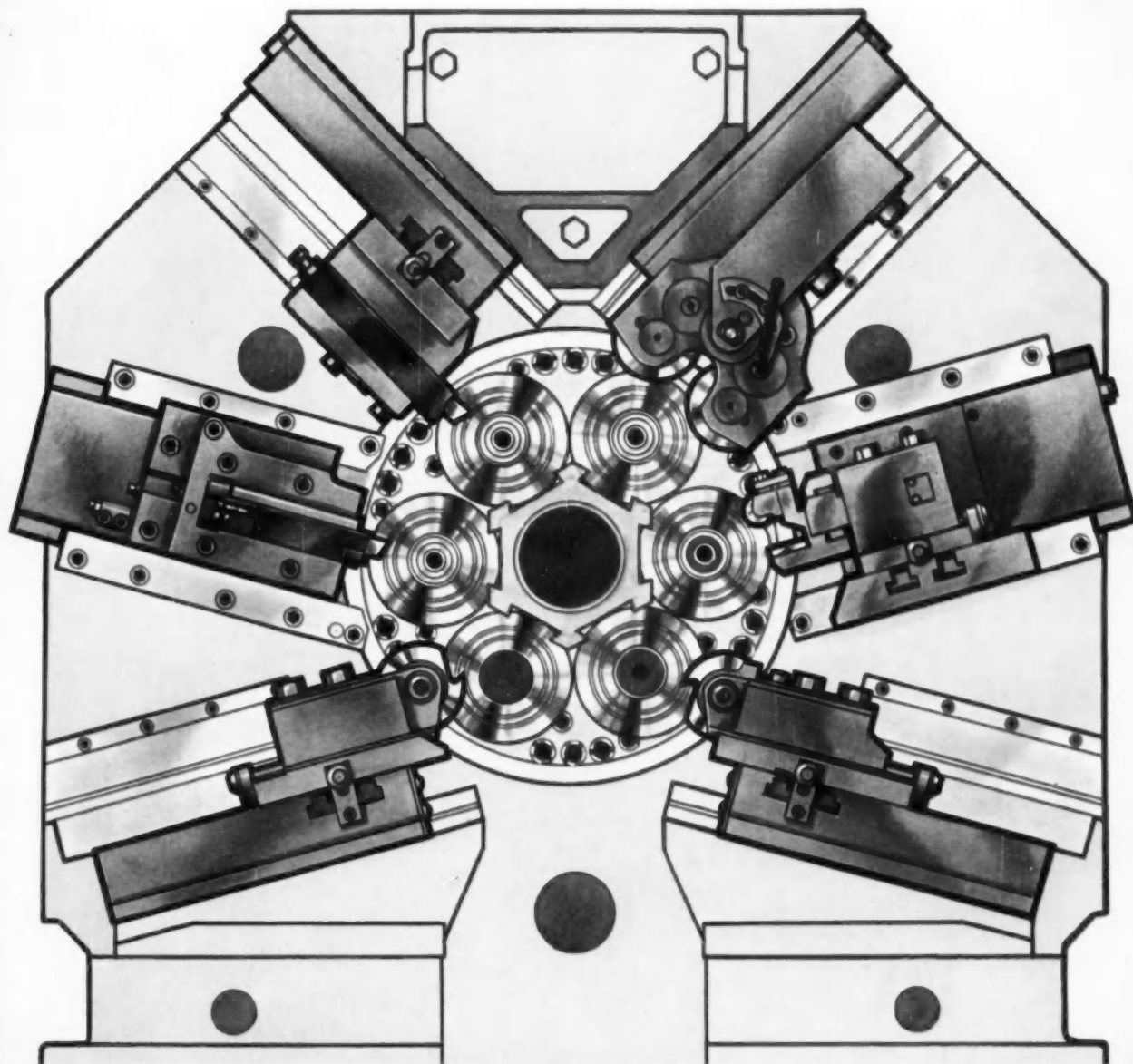
Truck, fork lift, gas, engine driven, 2000 lb cap—14—\$55,975

Truck, fork lift, gasoline engine driven, 6000 lb cap—277—\$1,326,902

### Readers of

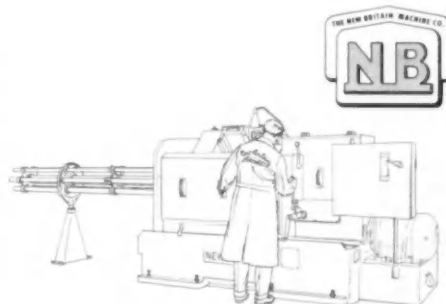
**AUTOMOTIVE INDUSTRIES**

*are always well informed*



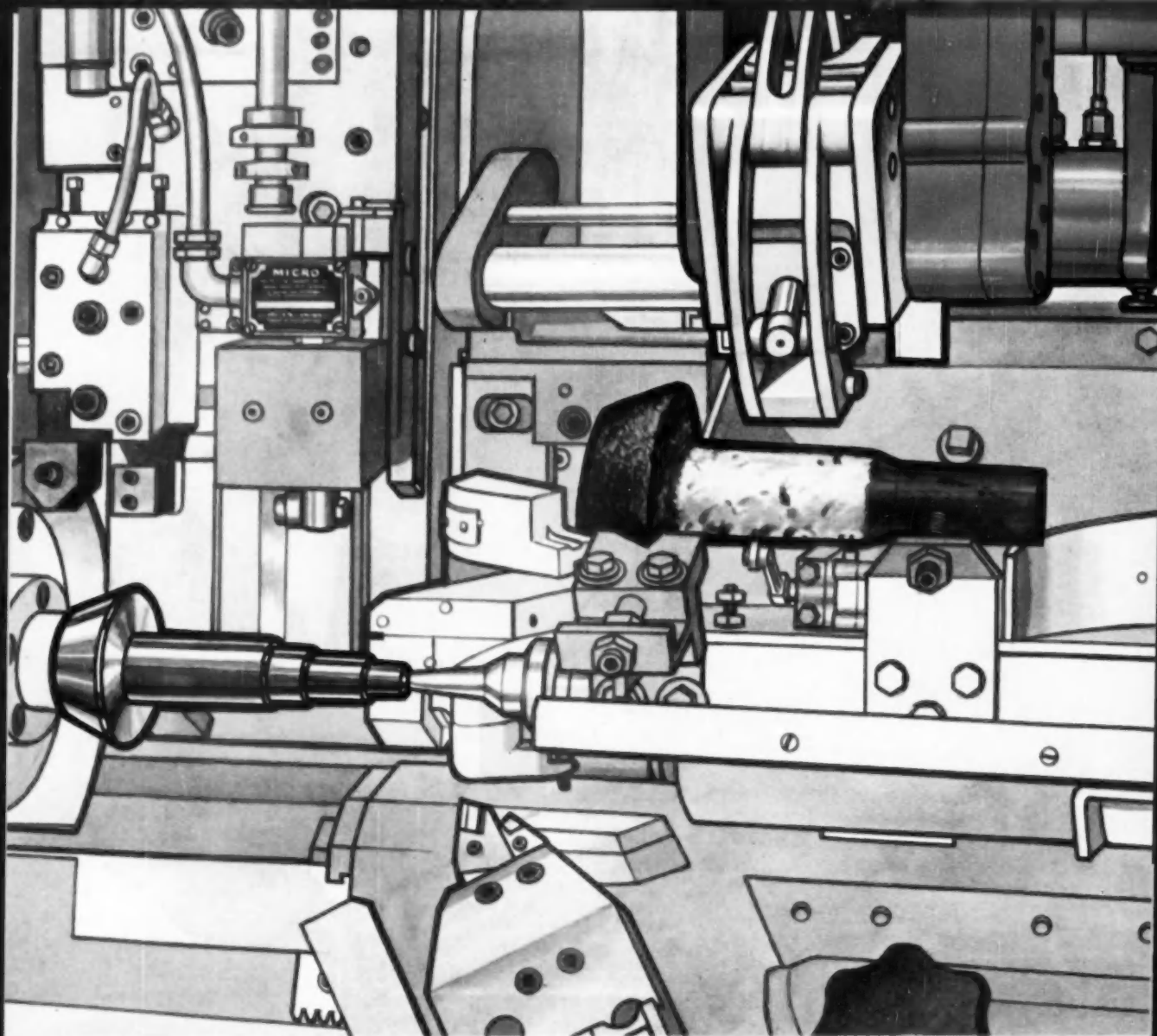
## six spindles — six cross slides

**H**ere you see the possibilities for new flexibility of bar machine set-ups with a *cross slide in every position*. Six independent cross slides. More operations on one bar machine. Six independent radial cross slides for forming, roll threading, shaving, skiving, angular facing, knurling, hobbing and undercutting with simpler tools and attachments, through the use of cross slides. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



Automatic Bar Machine

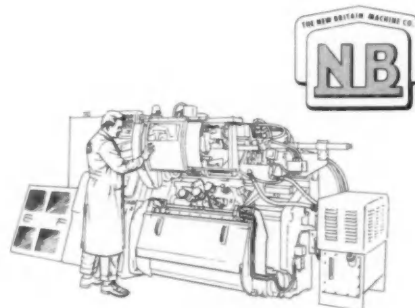




**no hands — no headaches**

**A**utomatic loading of forgings, bar slugs and bar stock is a basic optional design feature of New Britain **+GF+** Copying Lathes. It saves labor and makes a substantial reduction in production time per piece.

Positive, accurate loading, single point tooling and template control mean fewer headaches and larger profits on your lathe work. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



New Britain **+GF+** Copying Lathe

## New Defense Facilities

**A**DDITIONAL Certificates of Necessity below authorize accelerated tax amortization of new or expanded facilities for manufacture of automotive and aviation defense goods. These were issued by the Office of Defense Mobilization during the period June 27 through July 25. Dollar values shown are face amounts of the certificates. Figures in parentheses are the percentages of these private-capital investment amounts allowed for tax write-off over five-year periods.

**AMERICAN WELDING & MFG. CO.,** Warren, Ohio  
Military jet engine components—\$287,600 (70)

**BELL AIRCRAFT CORP.,** Wheatfield, N. Y.  
Military aircraft—\$157,503 (65)

**BENDIX AVIATION CORP.,** Eclipse-Pioneer Div., Teterboro, N. J.  
Research and development—\$249,001 (65)

**BENDIX AVIATION CORP.,** North Hollywood, Calif.  
Military aircraft components—\$154,500 (40)

**BRILES MANUFACTURING,** El Segundo, Calif.  
Titanium fasteners for military use—\$988,924 (65)

**CLEVELAND PNEUMATIC TOOL CO.,** National Water Lift Co. Div., Kalamazoo, Mich.  
Military aircraft parts—\$400,000 (40)

**GENERAL MOTORS CORP.,** Oak Creek, Wis.  
Guided missiles—\$10,193,000 (45)

**GOODYEAR AIRCRAFT CORP.,** Litchfield Park, Ariz.  
Military aircraft parts—\$81,007 (55)

**HUGHES AIRCRAFT CO.,** Culver City, Calif.  
Research and development—\$859,387 (65)

**MARTIN CO.,** Orlando, Florida  
Guided missiles—\$5,039,235 (65)

**NATIONAL MALLEABLE & STEEL CASTINGS CO.,** Superior, Wis.  
Steel castings—\$3,475,000 (65)

**NORTHROP AIRCRAFT, INC.,** Anaheim, Calif.  
Military aircraft—\$72,385 (65)

**NORTHROP AIRCRAFT, INC.,** Hawthorne, Calif.  
Military aircraft—\$88,632 (60)

**TENK MACHINE & TOOL CO.,** Cleveland, Ohio  
Military jet engine parts—\$90,105 (70)

**UNITED AIRCRAFT CORP.,** Windsor Locks, Conn.  
Military aircraft components—\$2,985,348 (65)

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### **Panalarm Annunciator pinpoints process "off-normals"**

In the process industries and among users of automatic machinery, trouble is minimized when it's caught early. That's the purpose of the Panalarm Annunciator System — a continuous monitor of your process.

One typical adaptation of the modular Panalarm system is engineered to differentiate between the first "off-normal" and subsequent "off-normals" caused by the first. This feature allows instantaneous recognition of the prime source of trouble in a "chain reaction."

Another adaptation is designed specifically for motor start-up and shut-down. It has also been successfully adapted for supervisory control, pump control and programming.

Your Panalarm sales engineer will be happy to make a survey of your requirements to determine whether a Panalarm system can aid productivity and safety in your process. For electrical and mechanical data on standard systems, request Catalog 100B on your letterhead.



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Every day the nation's 537,682 oil wells are turning out 6,807,000 barrels of oil—an average of 12.6 barrels per well.

By 1965, the U. S. armed forces expect their peacetime requirements for jet fuel to exceed 14 million gal daily.

Over 100 lb of rubber, other than in tires, is used in over 550 parts of the present-day passenger car. Most of this rubber is oil-based.

During this decade, consumption of petroleum products in the U. S. has increased 73 per cent—to 8415 million barrels every day.

More than eight million tin cans, made of steel thinly coated with tin, are used in the air storage spheres of a supersonic wind tunnel. They form a type of "radiator" to help keep the stored air at a constant temperature.

More than two out of three cars sold today are sold on time, yet more money is paid back each month on automobile instalments than is added on contracts for new cars.

Commercial jet fuel requirements in 1955 were at the rate of approximately 1050 barrels per day; by 1960 this rate can be expected to rise to 32,000 barrels per day.

More than 70 per cent of the farms in the U. S. have cars, over 46 per cent have trucks, and over 28 per cent have tractors—all fueled or lubricated with petroleum products.

The control surface (about the size of an office desk top) of one U. S. guided missile is strong enough to support six heavy cars.



**YOU CAN  
SAVE TIME,  
TROUBLE  
AND COSTS  
with**

## **Formed Tubes...**

#### **★ Save Time**

We have a huge stock of dies and, when needed, tooling's fast. We also avoid delays by making our own electrically welded steel tubing, sizes from 3/8" to 3" OD.

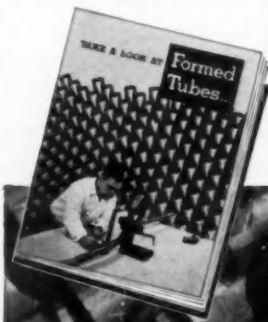
#### **★ Save Trouble**

Long, active experience with all tube forming processes and high standards of quality control make sure your orders will be completed *right*.

#### **★ Save Costs**

It's routine for formed tubes parts to deliver top performance, save weight, cut costs. Steel, copper, brass, aluminum or stainless tubing fabricated in 3/4" OD to 6" OD sizes; from 20 to 11 ga. metal.

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**resists  
impact**



These horns are built to stand sudden shock. And Parish Pressed Steel Division of Dana Corporation, a leading manufacturer of automotive chassis and frames, uses A.W. Dynalloy steel for the same reason...resists impact!

There are other reasons, of course. A.W. Dynalloy is  
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As with Parish Pressed Steel, A. W. Dynalloy can help you get more value per dollar spent for your product. Send for our A. W. Dynalloy booklet which gives complete information. Write Marketing Division, Dept. DY-S90.



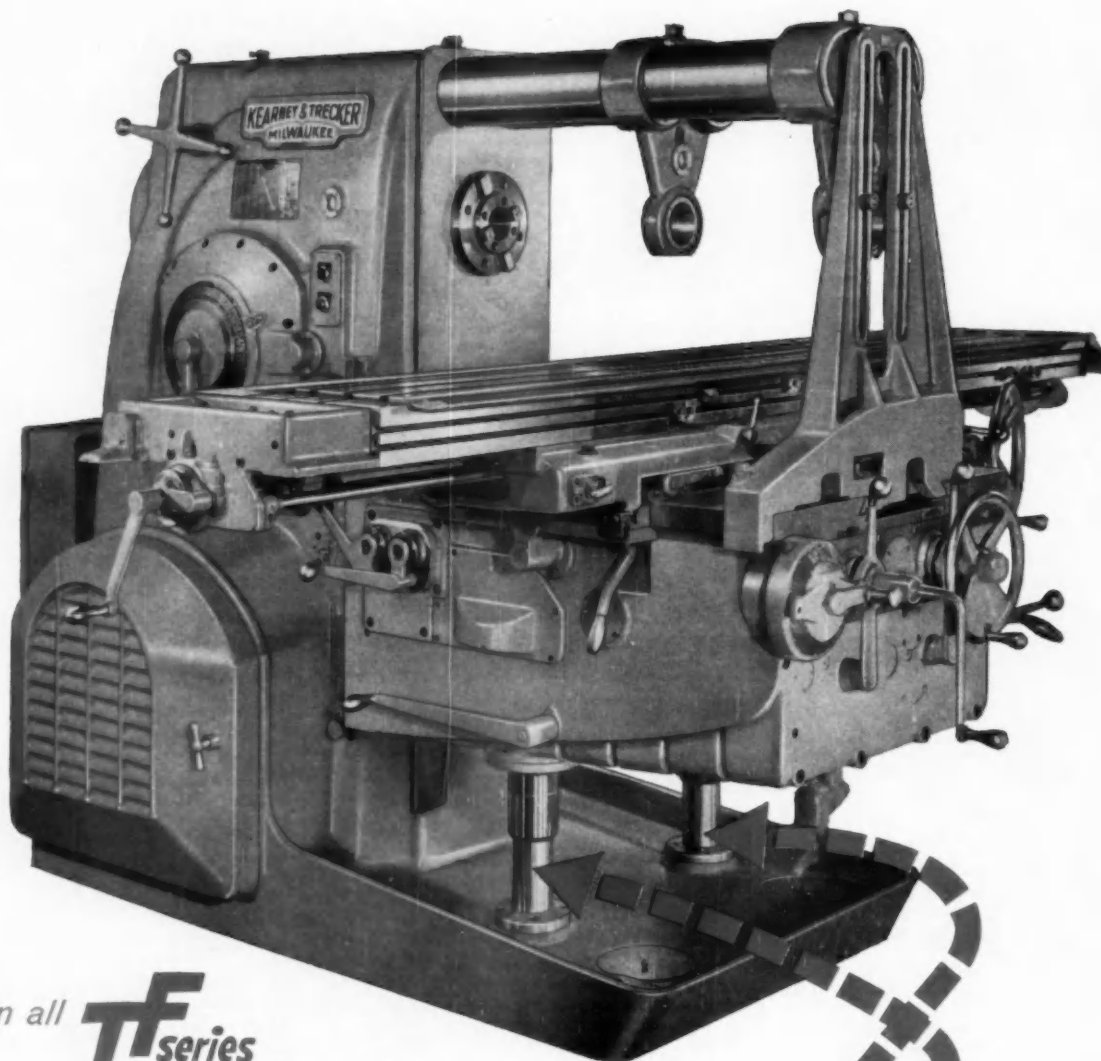
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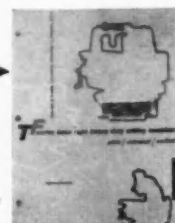
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## Overrun Barrier and Catapult

(Continued from page 63)

### Steam Catapult

The land-based catapult used in the demonstration is built of standard commercial components. It is, in essence, a huge steam-powered slingshot which produces 16 million ft lb of kinetic energy.

In operation, a 2000 psi generator builds up steam which is gathered in two accumulators. In launching, a valve is opened to release the steam so that it drives a piston the length of a long cylinder. The piston draws taut a cable to which the plane is attached to produce a smooth launching action. Airborne speed is thus built up in an aircraft long before it could reach it under its own power.



(Continued from page 37)

Rohr Aircraft Corp. will manufacture about \$21 million of struts and power packages for the Boeing B-52 jet bomber.

Robertshaw-Fulton Controls Co. will move its executive offices in early Fall to Richmond, Va.

Molded Fiber Glass Body Co. has purchased a 60,000 sq ft building to increase its productive capacity 150 per cent.

Motch & Merryweather Machinery Co. has appointed Tornquist Machinery Co., 3838 Santa Fe Ave., Los Angeles 58, Calif., as its representative in the Southern California area.

Alpha Molykote Corp. has organized a Technical Services Div. to handle engineering information on its line of molybdenum disulfide lubricants.

Flexonics Corp. will build a new plant on a 10-acre site at Santa Ana, Calif. . . . Dresser Manufacturing Div. of Dresser Industries, Inc., has completed a new million dollar compression fitting plant in Wellsboro, Pa.



Micromatic Hone Corp.—John H. Greening has been promoted to chief engineer, and Edward L. Behringer has been made assistant chief engineer.

## MEN in the NEWS

(Continued from page 41)

LeTourneau-Westinghouse Co.—D. H. Mitchell was made Eastern sales manager.

Westinghouse Electric Corp., Sunnysvale Mfg. Div.—W. H. Brandt has been named director of advanced systems engineering.

Bell Aircraft Corp.—William B. Sherman has been made director of commercial development.

Goodyear Tire & Rubber Co.—Harry L. Powell has been promoted to assistant to the vice-president in charge of original equipment sales.

Joseph T. Ryerson & Son, Inc., Plant Engineering Div.—Stanley J. Miller was made assistant director.

Montreal Locomotive Works, Ltd.—Daniel W. Cameron is now vice-president of manufacturing.

Dayton Steel Foundry—Daniel A. Walther has been named chief engineer.

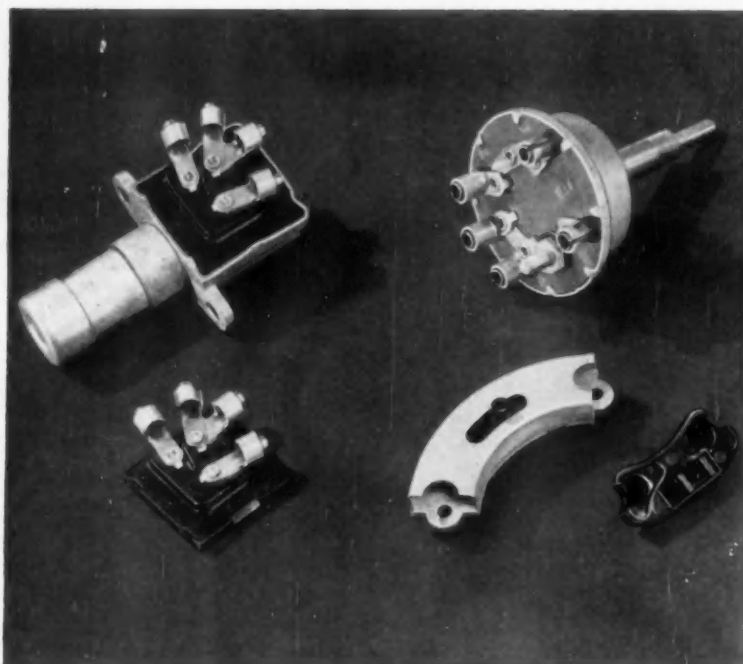
Baldwin-Lima-Hamilton Corp., Electronics & Instrumentation Div.—Arthur C. Ruge and Robert P. Lathrop are now director of research and manager of research and development, respectively.

Westinghouse Electric Corp.—Robert M. Harris has become sales manager of the Miniature Lamp Dept.

Joseph T. Ryerson & Son, Inc.—Frank W. Ingold has been named sales manager of the Cincinnati steel service plant, and Wilford O. Schwartz has been made sales manager for the St. Louis steel service plant.

Dodge Div., Chrysler Corp.—E. J. Newton has been promoted to regional sales manager for the Detroit region.





Where else can  
**DUREZ PHENOLICS**  
do the job best?

Foot dimmer, head lamp, and turn indicator switches demonstrate how successfully the advantages of Durez and metal can be combined when you are seeking lower unit cost and faster assembly with dependable performance.

Fluidity of these plastics in the mold permits designing to follow intricate metal contours. Where inserts are used, Durez forms a permanent anchorage, and the material is self-insulating

against heat and electrical current.

Add these properties to the resistance of Durez to moisture and to chemical action—its impact strength and molded-in surface luster—and the advantages of these thermosetting plastics in automotive components become clear.

For help in evaluating Durez for whatever you may have in mind, consult your molder. Or feel free to call on us for technical counsel.

**THERMOSETTING PHENOLICS HAVE  
PROPERTIES WORTH INVESTIGATING**

- Dimensional stability
- Non-conductivity
- Resistance to heat and cold
- Impact strength
- Resistance to moisture
- Chemical resistance
- Moldability in intricate shapes
- Moderate cost



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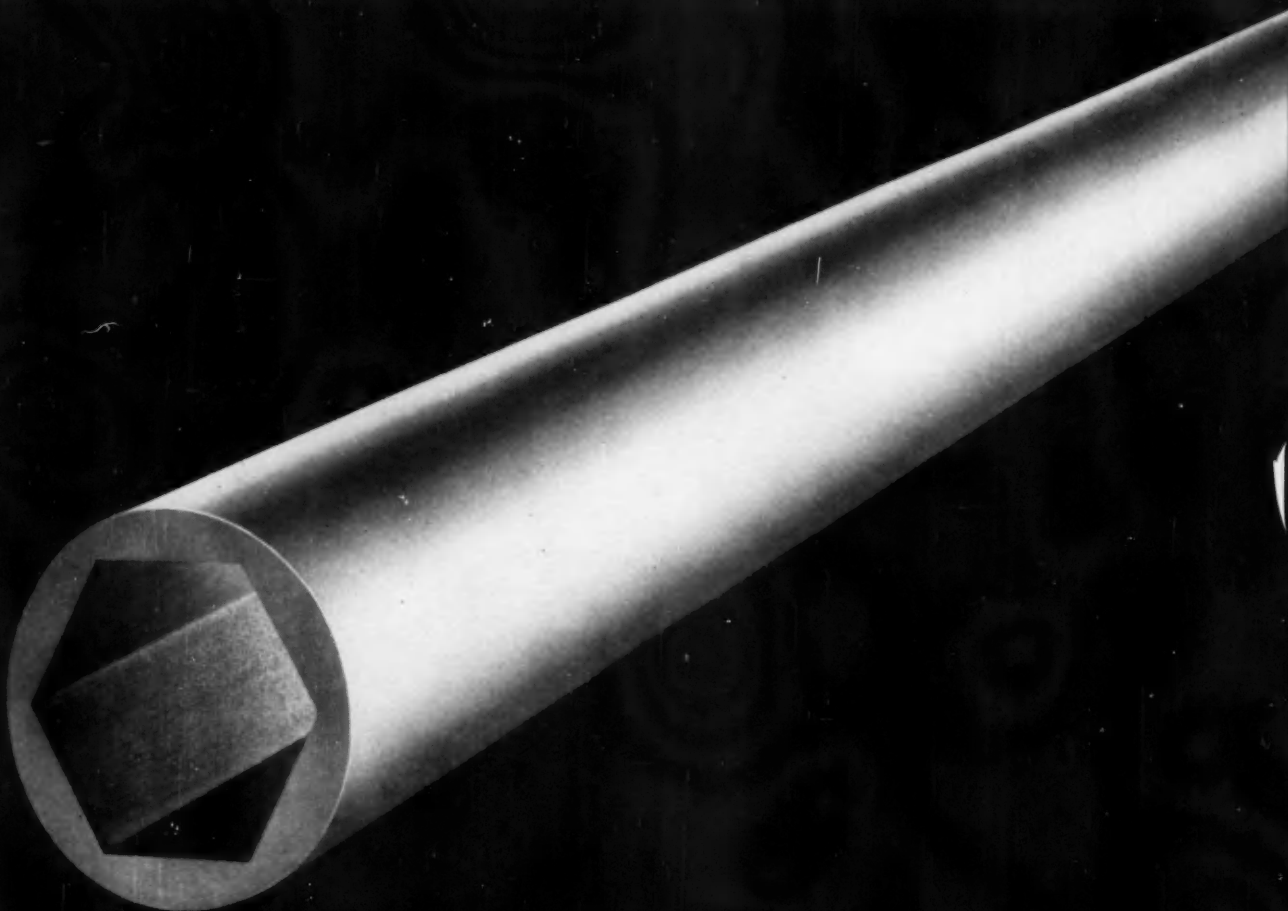
Government agencies accustomed to large procurement programs are already protesting the Administration's instruction to hold next year's purchases to this year's level. Such big buying agencies as the Air Force are expected to seek exception from the budget ceiling.

Full Government adoption of the Hoover Commission's recommendations for reforms faces a tough fight. About 40 per cent of the original recommendations have been adopted either in whole or in part; but they were mostly the non-controversial and less important ones. The difficult ones still must be put into effect. Defense Dept. is one of the toughest nuts for the Hoover commission supporters to crack.

Military programs through next June 30 will be financed by more than \$33.7 billion in new funds. The services also can use some of their \$10.2 billion unobligated from earlier years.

The cut-back in military troop strength won't effect military buying much, nor is it deep enough to result in any overall lessening of national defense. Congressmen of both political parties agree that new weapons reduce the need for masses of men in the Army, the Navy, and the Air Force.

The Air Force isn't the only branch of the military which expects to have an increasingly large number of idle plants. The Army is also worrying now about the costs of laying away production facilities, setting up reactivation methods, and computing requirements for critical materials in case of another emergency.



## EVER TRIED MACHINING A SPECIAL I.D. SHAPE?

—in stainless steel, with each part 22 inches long, the outside diameter a shade over 2 inches and with tolerances of  $+.000$ " to  $-.010$ " across the flats?

On jobs like this, there's possible trouble ahead if you start with solid stock, or even round heavy wall tubing. Machining problems, surface finishing, scrap loss, special cutting oils or compounds—added to the original stock cost may make the final cost of the part prohibitive.

There is one sure way of minimizing your production problems and costs involving hollow cylindrical parts and products—**DESIGN WITH B&W MECHANICAL TUBING.**

Before you start your next production run, call Mr. Tubes at your nearby B&W Tubular Products

Division District Sales Office—let him match tubing steels, types, finishes, shapes and tolerances to your applications—he will show you how to keep final costs low. Or write for bulletins 361 and 340. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.



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Seamless and welded tubular products, seamless welded fittings and forged steel flanges—in carbon, alloy and stainless steels.



*vibration*

use the instrument that often  
pays for itself in one application...

**CEC VIBRATION METER**

Type 1-117

When control of vibration is critical, CEC's 1-117 Vibration Meter is one of the best investments your company can make. Extremely versatile, accurate and rugged, the portable 1-117 is recommended for any vibration analysis where 115 volt, 50/60/400-cycle a-c is available.

Case histories prove this quality instrument quickly paid for itself many times over in laboratories and jet-engine production and overhaul facilities... more than doubled machine tool life by pinpointing vibration amplitudes of less than 0.0001".

*For complete specifications, please write for Bulletin CEC 1538B-X16, or contact your nearby CEC field office.*

PROVIDES DIRECT READINGS of average velocity and either linear or torsional peak-to-peak displacement on a large, easy-to-read meter. Output may also be connected to an oscilloscope or oscillograph for more detailed wave-form study.

FEATURES 4 INPUT CHANNELS with individually adjustable sensitivity... interchangeable high-pass filters for low-frequency cut-off... highly stable amplifier. The 1-117 is also adaptable to rack mounting. The only external accessories needed are suitably matched, self-generating pickups.

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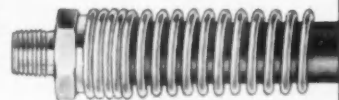
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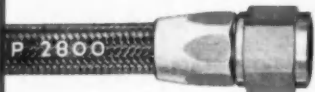
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**AIR BRAKE LINES**—2550 Truck Air Brake Hose and reusable one-piece **SOCKETLESS** Fittings for all bus and truck air brake lines. Approved by Pennsylvania Bureau of Highway Safety. In standard 3/8" size, for pressures up to 150 psi.



**AIR COMPRESSOR DISCHARGE LINES**—2800 Air Compressor Discharge Hose with Reusable Fittings is designed to withstand temperatures up to 500°F. without becoming brittle or cracked and to minimize carbon pickup, a major cause of line failure. In sizes up to 1 1/4"; for pressures up to 125 psi.



**HIGH TEMPERATURE LINES**—2802 Teflon Hose and Reusable **"super gem"** Fittings for fluid systems subject to high temperature and corrosive fluids. Hose and fittings can be assembled with ordinary hand tools. In sizes from 1/4" to 1"; for pressures up to 1500 psi; temperature range -100°F. to +500°F.



**FREON SELF-SEALING COUPLING**—5400 Type Freon Self-Sealing Coupling is designed for use on automotive air conditioning systems. Permits installation of precharged components and servicing without charging and bleeding Freon system. In sizes from 1/4" to 1 1/8".



**LOW PRESSURE FUEL LINES**—2601 Diesel Fuel Hose and Reusable Fittings for fuel systems up to 500 psi. In 1/2", 3/4", 1", 1 1/4", 1 1/2" and 2" sizes; temperature range -40°F. to +300°F.



**"super gem"** and **SOCKETLESS** are Aeroquip trademarks

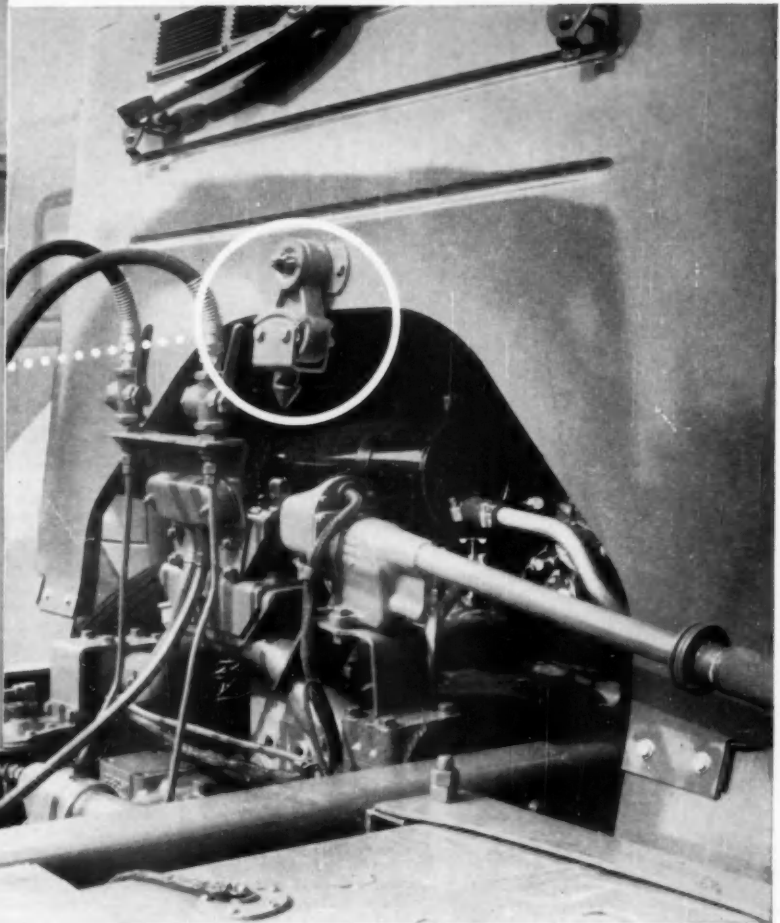
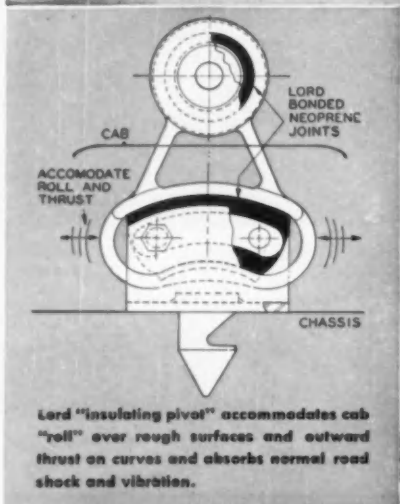
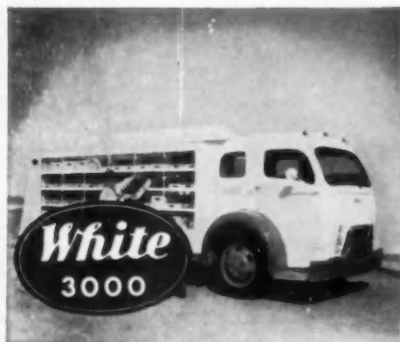
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## LORD "insulating pivot" contributes to smooth ride of WHITE tilt cab

The unique power-lift cab feature of White 3000 Series Trucks required a connecting device to anchor the rear of the cab to the vehicle frame. Such a device must combine high strength with resiliency to provide smooth, noiseless riding.

White called on LORD Vibration Control Engineers to tackle the problem. LORD's solution was an "insulating pivot"—a rugged bonded rubber mounting which absorbs road noise and cab motion—and requires no maintenance.

As a result, White has used these LORD mountings for four years as standard equipment without a single failure reported. This LORD Mounting replaced an all-metal sliding link which was subject to excessive rattling, costly maintenance and frictional wear.

Wherever noise and vibration are a problem, LORD will design the most efficient solution as a service to you. For further information, call your nearest LORD Field Engineer or the Home Office, Erie, Pennsylvania.

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DALLAS, TEXAS - Riverside 3392

DAYTON, OHIO - Michigan 8871  
DETROIT, MICH. - Trinity 4-2060  
LOS ANGELES, CAL. - Hollywood 4-7593  
NEW YORK, N. Y. - Circle 7-3326  
PHILADELPHIA, PA. - Locust 4-0147

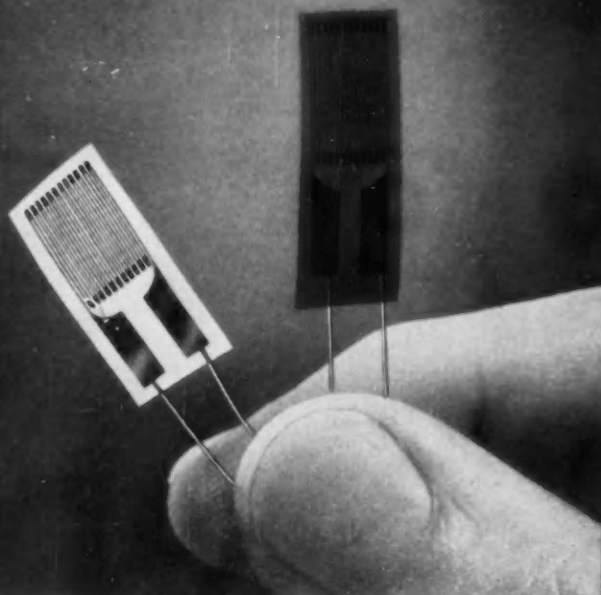
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## Newest strain-measuring equipment from Baldwin



Foil gages shown above are enlarged to twice their actual size.

### NEW SR-4® strain indicator and NEW SR-4 bonded foil strain gages

#### Type N SR-4 Strain Indicator

This new, improved strain indicator features printed circuits and transistors, weighs one-third less than the previous model and has a smaller case. No warmup is required. In intermittent service its batteries last up to five times as long and cost two-thirds less. The legs of the case are positioned to permit tilting for improved readability. For direct readings with full external bridge, no calibration correction is required. Used as a preamplifier with standard cathode ray oscilloscope, it gives visual indication of dynamic strain with better response and in a broader range than the previous model. Frequencies up to 300 cps at amplitudes up to 3500 microinches per in. can be observed without appreciable distortion.

#### SR-4 Bonded Foil Strain Gages

Two new types of foil gage in ½ in. gage length, 120 ohms resistance, now make many types of stress analysis possible with new accuracy and ease. A Bakelite-bonded gage, Type

FAB-2, and a quick-drying paper-and-cement-bonded gage, Type FAP-2, have marked advantages over comparable standard bonded wire strain gages. Hysteresis is now so low as to be negligible for stress analysis. Fatigue life of the paper gage matches that of comparable wire gages—that of the Bakelite gage is longer. Lateral strain sensitivity of both is down by one-half, offering new accuracy in measuring biaxial strains. The quick-drying paper gage is quick and easy to install. The Bakelite gage offers such attractive features as dependable service at 300°F or higher. It is thinner and more flexible than comparable bonded wire gages—requires no preforming for curved surfaces and is thus easier to apply. Its glass fiber filler makes it less sensitive to moisture effects.

Both new foil gages have tinned lead wires, well anchored and easy to connect. Both gages are now stock items for prompt delivery. For more information on this or other Baldwin stress analysis equipment, write to Electronics & Instrumentation Division of B-L-H, Waltham, Mass. Or we will have a representative call on you at your request.

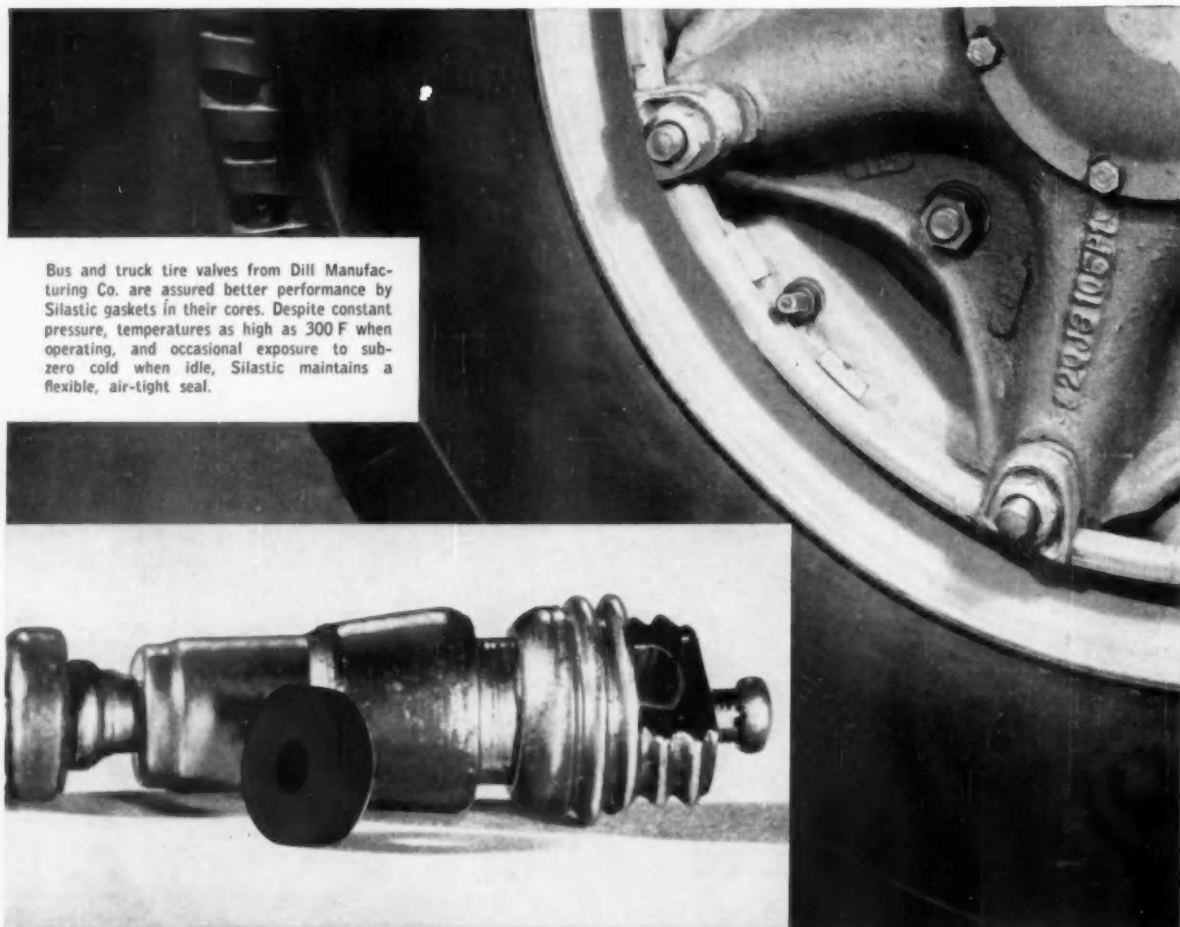
**BALDWIN · LIMA · HAMILTON**  
Electronics & Instrumentation Division

Waltham, Mass.

SR-4® strain gages • Transducers • Testing machines







Bus and truck tire valves from Dill Manufacturing Co. are assured better performance by Silastic gaskets in their cores. Despite constant pressure, temperatures as high as 300 F when operating, and occasional exposure to sub-zero cold when idle, Silastic maintains a flexible, air-tight seal.

# SILASTIC

SILICONE RUBBER

## resists heat, cold, high compression

For resistance to fuels, oils and solvents, specify Silastic LS

Get latest data on Silastic. Mail coupon today

Dow Corning Corporation, Dept. 0620  
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Please send me latest data on Silastic

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COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

ZONE \_\_\_\_\_

STATE \_\_\_\_\_

\*T.M. REG. U.S. PAT. OFF.

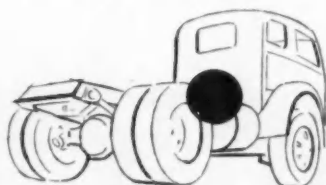
### Typical Properties of Silastic for Molded Parts

• Temperature range, *F	-130 to 500
• Tensile strength, psi	600 to 900
• Elongation, %	150 to 300
• Compression set, %, @ 300 F	15 to 40
• Hardness range, durometer	20 to 90
• Dielectric strength, volts/mil	400 to 500
• Oil resistance	Dependent on type of oil

If you consider ALL the properties of a silicone rubber, you'll specify SILASTIC

first in  
silicones

**Dow Corning CORPORATION**  
MIDLAND, MICHIGAN

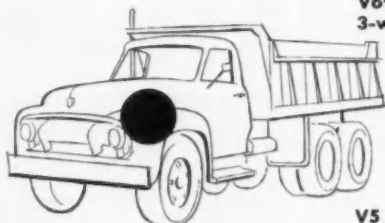


**V69 Series**  
3-way



#### FOR SADDLE TANK OPERATION

On trucks equipped with saddle tanks, the Skinner V69 Solenoid Valve can make fuel level readings and tank switching a one-step, push-button operation.

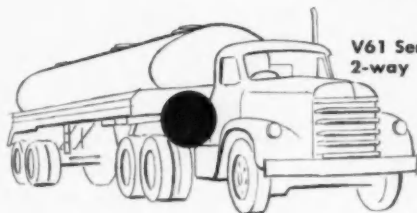


**V5 Series**  
2-way



#### FOR DIESEL CUT-OFF

On diesel trucks, the Skinner V5 Solenoid Valve can be used to automatically shut the engine down by cutting off the fuel to the injectors.

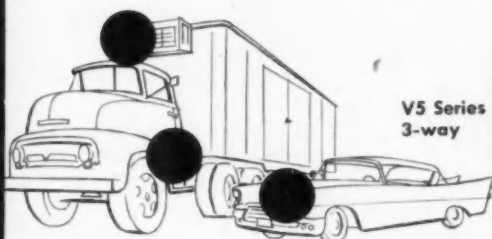


**V61 Series**  
2-way



#### FOR PROPANE AND BUTANE CUT-OFF

On high pressure propane and butane trucks, the Skinner V61 Solenoid Valve can be used to automatically shut off the tanks from the fuel system when the vehicle is not in operation.

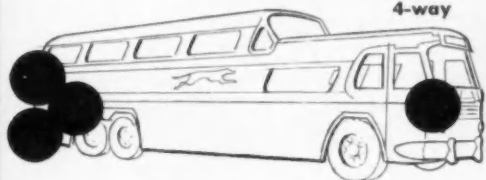


**V5 Series**  
3-way

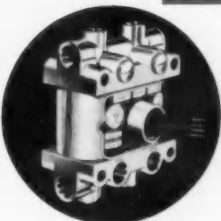


#### FOR AIR AND HYDRAULIC CONTROL

Skinner V5 Solenoid Valves are employed to control the operation of cylinders, diesel racks, clutches, brakes, governors, transmissions; also heating, refrigerating, fuel and air suspension systems.



**V9 Series**  
4-way



#### FOR SWITCH CONTROL

Skinner V9 Solenoid Valves can be used with confidence in conjunction with centrifugal, thermal, ignition and limit switches to automatically perform such sequencing, interlocking and safety functions as door opening and closing, ventilation, air conditioning, etc.

## Skinner Solenoid Valves can help you solve many different control problems

No matter what your control problem is, chances are a Skinner Solenoid Valve can solve it. "On-the-road" tests show these valves can take it under all conditions.

In addition to quality and simplicity of design, Skinner Solenoid Valves have features that assure long, uninterrupted operation of any system which uses them.

If your problem is fuel control, air conditioning, ventilation, door opening or closing, suspension, fuel

injection, etc., consider the use of Skinner Solenoid Valves — there are over 100,000 variations available, which means custom design from standard parts. Let our application engineering department show you how they can meet your specific requirements.

For complete information, write us at Dept. 338 or contact a Skinner Representative (they are listed in the Yellow Pages).

*Skinner Solenoid Valves are distributed nationally*



# SKINNER

**ELECTRIC VALVE**  
**DIVISION** NEW BRITAIN  
CONNECTICUT  
105 EDGEWOOD AVENUE

THE CREST OF QUALITY



# reduce cabinet breakage 70% at Motorola

**The Problem:** Motorola's assembly line in Quincy, Illinois experienced difficulty fastening chassis and fibre backing to plastic radio cabinets. Time was lost repairing cabinets broken by over-tightened screws . . . profits were reduced by discarded cabinets.

**The Solution:** Thirteen CP "Magnamatic" One Shot Air Screwdrivers replaced previous tools that did not provide sufficient quality control.

**The Result:** CP "Magnamatics" have been on the job for over eighteen months. Rejects have dropped 70 to 80 percent. The CP "Magnamatic" One-Shot clutch—runs nuts or screws to precise, pre-set torque—prevents over-tightening, makes it almost impossible to crack plastic cabinets or strip screw threads—doesn't ratchet, eliminates surface damage to lustrous plastic finishes. And more! Bonus benefits of "Magnamatics" include: a new low in maintenance costs (averages only 11¢ per tool per month), quiet operation and no cost or time lost due to bit breakage.

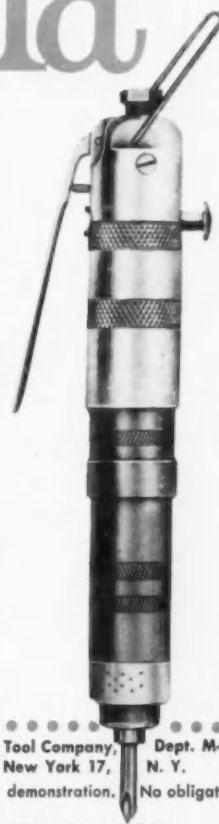
**Capacities: #4 screws to 3/8" bolts. Reversible and non-reversible types.**



## Chicago Pneumatic

8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES  
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



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8 East 44th Street, New York 17, N. Y.  
☐ Please arrange demonstration. No obligation, of course!  
☐ Please send me FREE booklet SP-3165 "Magnamatic Case Histories"  
☐ Please send me FREE Bulletin 580 on "Magnamatic" units for multiple applications.

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Company \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_



## HELIARC Welding finds satellite jobs are right in its orbit

Welding together sections for an earth satellite, under the most exacting specifications, may not be your particular problem. But if welding light-gage, hard-to-weld metals is slowing up your production—LINDE's HELIARC Inert Gas Shielded Arc Welding, using LINDE Argon as a shielding gas, may be just what you've been looking for.

HELIARC Welding is LINDE's method for high-speed fusion of commercial metals, automatically, or manually in all positions. LINDE Argon, guaranteed 99.99% pure, protects the weld. It is readily available, in cylinders or in bulk, from convenient sources all over the nation.

Get more information about HELIARC Welding and LINDE's other modern welding methods. For a free copy of the booklet, "Modern Methods of Joining Metals," address Dept. H-83, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. In Canada: Linde Company, Division of Union Carbide Canada Limited.

**FOR THE BEST IN ELECTRIC WELDING—LOOK TO LINDE!**



Shells of the Earth Satellite, Project Vanguard, are made of .050-in. magnesium alloy sheet, containing small amounts of aluminum and zinc. Internal framework and pressure chamber cover ring (above) are manually welded by HELIARC Welding, a LINDE development utilizing an argon-shielded tungsten arc. Brooks & Perkins, Inc., are the fabricators.



TRADE-MARK

**UNION  
CARBIDE**

The terms "Linde," "Helicarc" and "Union Carbide" are registered trade-marks of Union Carbide Corporation.



## Aluminum Door Frames

reduce costs, add beauty,  
permit flexibility and  
integration of design  
in fine new cars.....▶



The Finest Products  
Made with Aluminum

are made with

REYNOLDS  ALUMINUM

From a cost standpoint, aluminum door frames offer the advantages of tooling simplification, flexibility of styling modification, economy of construction, integration of design (rail, inner and outer trim molding, for example, can be combined into a single aluminum extrusion). From a sales standpoint, aluminum door frames will not rust, chip, pit, peel or flake. There's added customer appeal in this lasting beauty feature.

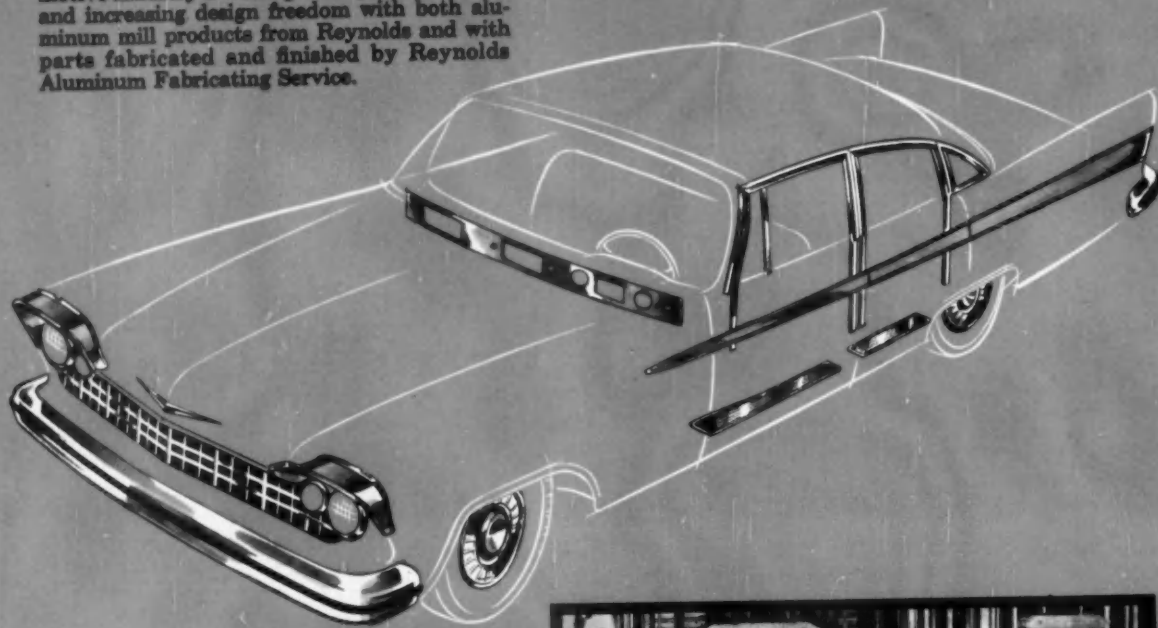
Strong, lightweight aluminum door frames are but one of many examples of how the automotive industry is adding beauty, cutting costs and increasing design freedom with both aluminum mill products from Reynolds and with parts fabricated and finished by Reynolds Aluminum Fabricating Service.

## Reynolds Aluminum

THE METAL FOR AUTOMATION®

The Finest Products  
Made with Aluminum  
are made with  
**REYNOLDS ALUMINUM**

TRADE MARK

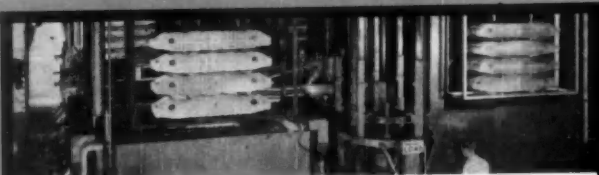


The photos here illustrate examples of the vast fabricating and finishing facilities that Reynolds offers the automotive industry. From these facilities come sales appealing *color anodized* parts with the "gleam of gold" and *clear anodized* parts with the "look of sterling." From these facilities come *quality* parts... quality controlled from mine to finished part and backed by Reynolds technological know-how in producing and fabricating aluminum. *Economical* parts, too, because of Reynolds tremendous variety of the most modern fabricating and finishing equipment.

For details on these facilities and for the assistance of Reynolds Aluminum Specialists on mill product applications or on fabricated parts, contact your nearest Reynolds Office. Or write Reynolds Metals Company, Fisher Building, Detroit 2, Michigan or Reynolds Aluminum Fabricating Service, 2009 South Ninth Street, Louisville 1, Kentucky.

## Reynolds Aluminum Fabricating Service

BLANKING • EMBOSING • STAMPING • DRAWING • RIVETING • FORMING  
ROLL SHAPING • TUBE BENDING • WELDING • BRAZING • FINISHING



This new Reynolds automatic aluminum finishing system can finish mixed sizes and types of automobile parts and chemically brighten or anodize them in different colors—and can handle several different jobs at the same time. An automatic coding system establishes the individual finishing specifications for each job.



Part of a battery of Reynolds new high speed buffing equipment used here on 1957 hood moldings.



Part of a battery of Reynolds high speed coil fed presses used in the fabrication of automotive parts.



The tanks in this new Reynolds anodizing installation can handle parts 24' long, 12' high and 4' wide, making it possible to handle hundreds of trim parts at one time. This half-block long system is another new addition to Reynolds multimillion dollar finishing facilities investment.

WESTERN ELECTRIC  
Sheathes Cable  
with Metal Jacket on

# "Electronic Speedways"



## Record-Breaking Soldering Job Accomplished with ALLIS-CHALMERS INDUCTION HEATERS

**B**EHIND your taken-for-granted telephone is busy *Western Electric* — manufacturing and supplying units of the Bell System. The Allis-Chalmers induction heater is typical of the scientifically engineered machinery utilized by Western Electric in turning out record-breaking quantities of equipment and apparatus essential to dependable service.

In Western Electric's ultra-modern cable sheathing operation, four Allis-Chalmers 50-kw induction heaters at Kearney, N. J., and four identical units at Chicago make up electronic speedways.

Telephone cables 1¼-inch through 3-inch outside diameter race beneath specially designed induction coils which induce heat into

the overlapping areas of the corrugated metal sheathing enclosing the cables. Amount of heat induced depends upon cable speed. Voltage-generating tachometers, magnetic amplifiers and saturable reactors control amount of heat supplied by the coils. Heat is accurately controlled through all speed ranges.

### Mr. Hi Frequency is ready and able to help you, too

If your job is one of brazing, soldering, hardening, annealing, or melting, it will pay you to get all the facts on induction heating. Contact your A-C representative or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wis.

# ALLIS-CHALMERS



A-5373



To engineers who want to straighten  
out the curves in their careers...

**DOUGLAS TEAMWORK  
HELPS TO RELIEVE  
ENGINEERS OF  
BURDENSOME  
PROJECT DETAILS!**

There are no "dead end" jobs at Douglas. As part of a crack engineering team, you'll be encouraged to use your full talents. Important assignments will give you the opportunity for greater accomplishments and the kind of future you want for you and your family. Wherever you choose to locate — in California or across the nation — Douglas offers many career opportunities including...

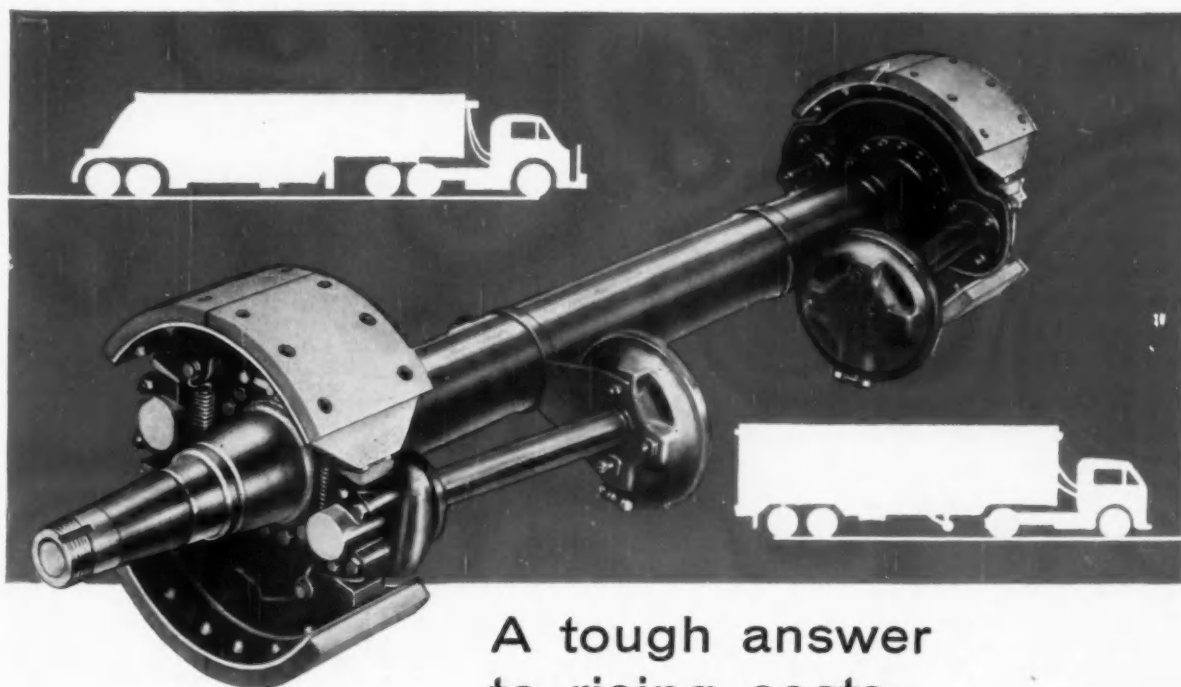
**TOP ASSIGNMENTS FOR AERODYNAMICISTS!**

Aeronautical Engineers with undergraduate and graduate degrees and Physicists with advanced degrees work on supersonic aircraft now in production ... and on hypersonic aircraft in all phases of development from design to ultimate delivery.

For important career opportunities in your field, write:

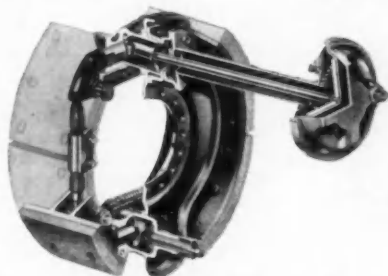
C. C. LaVENE  
DOUGLAS AIRCRAFT COMPANY, BOX C-620  
SANTA MONICA, CALIFORNIA



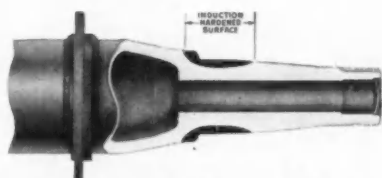


A tough answer  
to rising costs . . .

## CLARK tubular Trailer Axle!



**Advanced Brake Design**—Both shoes are free-floating and self-centering, assuring full lining contact and compensation for wear. Both shoes are fully energized in forward direction and one or both shoes fully energized in reverse.



**Induction Hardening**—For extra strength at a common area of failure, the inner wheel bearing surfaces are induction hardened, increasing the fatigue factor by 400 per cent.

- light, rugged alloy steel
- induction hardened bearing seat for increased strength
- revolutionary brakes—more efficient, lighter, fewer parts

Designed to carry loads effectively and to stop loads positively, safely, this Clark tubular axle is your smart, tough answer to climbing costs of operation.

- **New "High" in braking efficiency**—of revolutionary design the Clark MC (Maximum Capacity) Brake increases stopping action, and makes brakes last longer. No cam shafts, no slack adjusters—fewer parts, less weight.
- **Interchangeable parts cut inventory**—Two sizes of axle center use same wheel and brake parts—and these parts are also interchangeable with other makes of axle. Brake linings and shoes easy to remove—simplest possible design for low-cost maintenance.

As a sensible, practical step toward substantial operating savings, send for a helpful bulletin—the coupon gets it promptly.

**CLARK<sup>®</sup>**  
**EQUIPMENT**

**CLARK EQUIPMENT COMPANY • AXLE DIVISION, Buchanan 2, Michigan**  
Please send further information on new Clark Trailer Axle.

NAME \_\_\_\_\_ POSITION \_\_\_\_\_  
FIRM \_\_\_\_\_ ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_

# Tru-Stop Brakes

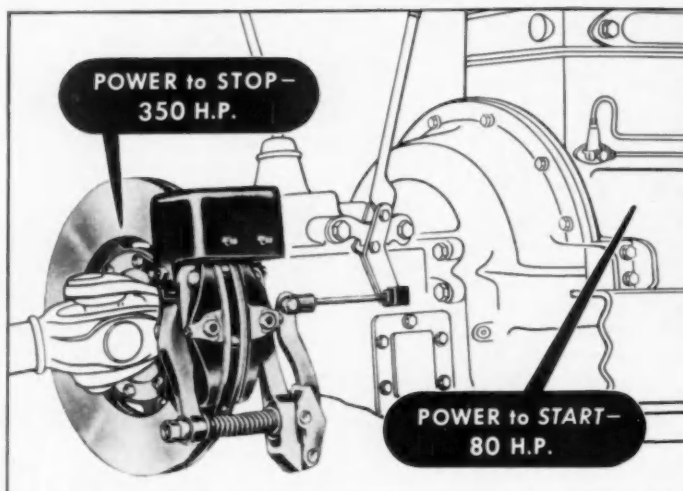
## Meet Every Heavy-Duty Safety Requirement

OFFER POSITIVE PROTECTION  
AGAINST RUNAWAY OR PARKING  
ACCIDENTS—AT LOWEST COST

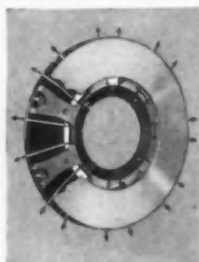
### HERE IS WHY:

**They have surplus power  
required for emergency  
service—no dangerous  
self-energizing**

TRU-STOP Heavy-Duty Emergency Brakes are not only excellent parking brakes. They serve as a complete, independent and fully reliable braking system. Operating on the propeller shaft they enable the driver to continue on safely in the event of service brake failure. TRU-STOP brakes have the surplus braking capacity to be used repeatedly as an auxiliary to service brakes.

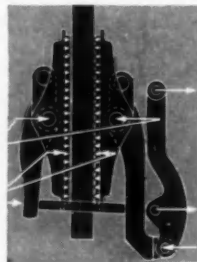


*Brakes actually do more work than the engine in terms of horsepower. Where it takes 80 HP to accelerate to 20 miles per hour, it takes 350 HP to make a safe stop from 20 miles per hour within required limits*



### Ventilated to throw off heat

Brake efficiency depends on ability to throw off intense heat—rapidly. Discs of TRU-STOP brakes are exposed to the air even during the braking operation. Ventilated design circulates air between the disc plates.



### Give uniform brake pressure

Disc of TRU-STOP brakes is "squeezed" between the flat surface of the shoes. Effort applied to brake lever operates front and rear lever arms simultaneously. Pressure is exerted on the center of each shoe. Entire lining surface is in contact.

## FOR SAFE, ECONOMICAL, HEAVY-DUTY BRAKING WITH MAXIMUM LIFE AND MINIMUM MAINTENANCE

TRU-STOP Brakes are used on a great variety of mobile and stationary equipment  
**SUCH AS—**

Motor cranes  
Road rollers  
Dump trucks  
Power dividers  
Cooling tower fans  
Oil well pumps  
Cold header presses  
Scrubbing machines  
Wire rope stranders  
Fork lift trucks  
Motor scrapers

Tractors  
Graders  
Diamond core drills  
Electric locomotives  
Oil well servicing rigs  
Railway inspection cars  
Shapers  
Power take-offs  
Winches  
Motor shovels

Tractor loaders  
Conveyors  
Hard rock drill positioners  
Mine locomotives  
Power presses  
Railway power ballisters  
Cable tool spudders  
Aerial tram cars  
Tension wire stringers

We will be glad to  
answer any questions  
or give you more de-  
tailed information  
about TRU-STOP  
Heavy Duty Emer-  
gency Brakes.  
Send for

Catalogs  
DH-33  
and  
DH-530



## Automotive and Aircraft Division AMERICAN CHAIN & CABLE

601 Stephenson Building, Detroit 2  
2216 S. Garfield Street, Los Angeles 22 • Bridgeport 2, Conn.





Sustained operating temperatures up to 400° F. as in guided missiles, are death to inferior electrical insulations and laminates. CDF glass-base laminates of Teflon®—the only laminates of their kind approved by the military—can take this punishment steadily.

## LATEST HIGH-HEAT INSULATION SYSTEMS NEED CDF GLASS-BASE LAMINATES AND TAPES

**Widest available range offers Teflon, epoxy, silicone, mica products for dimensional stability under continuous heat**

As components and equipment grow smaller, and heat becomes more difficult to dissipate, CDF high-heat electrical insulations become increasingly important to electronic design. For nowhere else can such a wide range of quality insulations be found under one roof as at CDF.

**FOR HIGH-HEAT PRINTED CIRCUITRY,** CDF glass-base metal-clad laminates of Teflon® and epoxy exhibit best dimensional stability and current-carrying capacity. Constant operating temperatures of 300°F — soldering temperatures to 500°F — are readily met by these specialized CDF Dilecto® laminates.

**HIGH-HEAT FLEXIBLE INSULATIONS.** CDF offers a wide choice of insulating tapes made of Teflon, silicone varnish, silicone rubber, and Micabond®, with glass-cloth support. CDF tapes may be used either by hand

wrapping or on automatic winding machines. Unsupported Teflon in colors available to meet MIL-STD 104.

**TEFLON SPAGHETTI TUBING AND OTHER SPECIALTIES.** Part of CDF's vast fabrication facilities is devoted to the production of custom parts from Teflon — spaghetti tubing, rods, sheets, and machined parts to rigid specifications.

**NEW** — cementable Teflon, bondable to itself and to other materials with commercial adhesives.

**SEE SWEET'S** Product Design File, Electronics Buyers' Guide, and other directories for the name and phone number of your CDF sales engineer. Then send your print or your problem, and we'll return specific technical data and test samples.

\*trademark of DuPont tetrafluoroethylene resin



**CONTINENTAL-DIAMOND FIBRE**

A SUBSIDIARY OF THE ~~Bush~~ COMPANY • NEWARK 2, DEL.



# KING-SEELEY

*Automotive Instrumentation*



SKILLFULLY  
ENGINEERED

DISTINCTIVELY  
STYLED

PRODUCED  
UNDER  
QUALITY  
CONTROL



KING-SEELEY CORPORATION

ANN ARBOR,  
MICHIGAN

# YOUNGSTOWN QUALITY PAVES THE WAY



*Producers of Quality  
Carbon and Alloy Steels  
for over Half-a-Century*

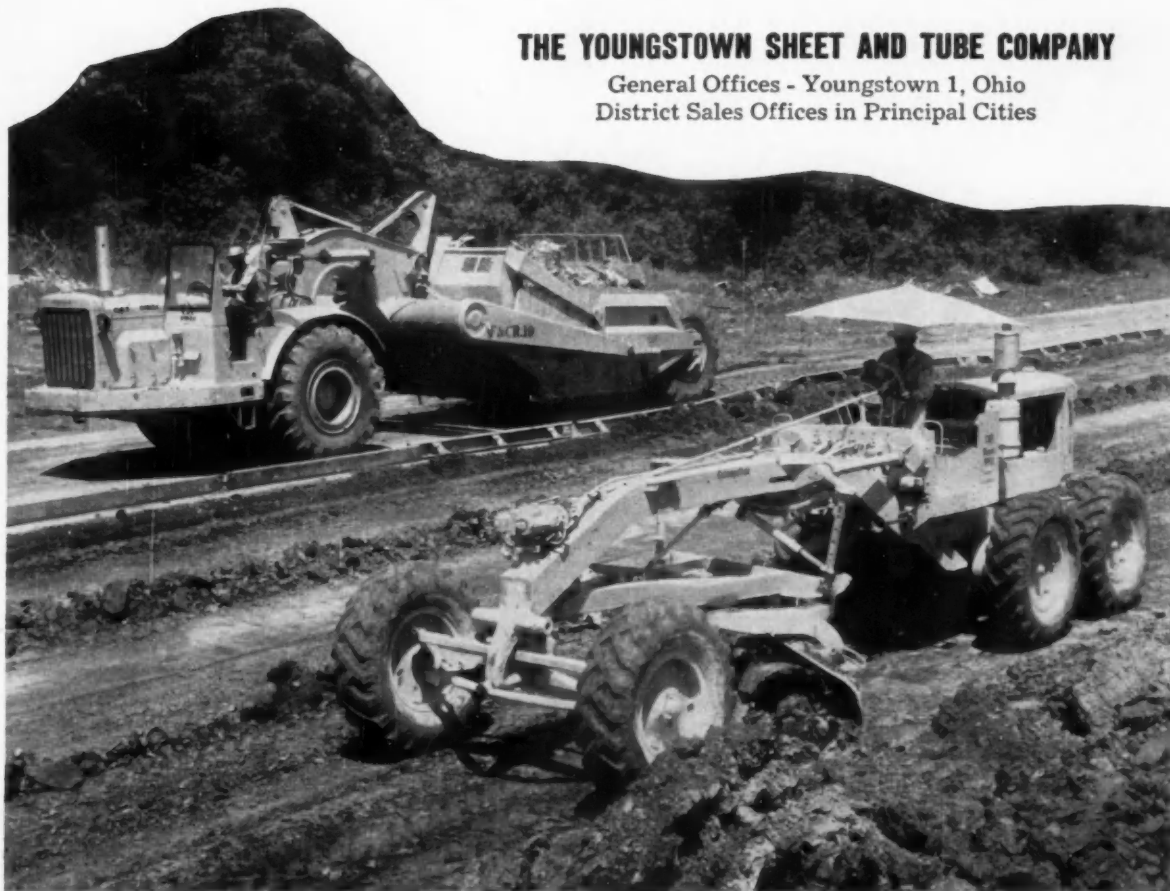
The Motor Grader and Tractor-Scraper—shown working on the site of Houston's multi-million-dollar "Shopping City of Gulf-gate", are designed for rugged service requiring tough strong steel construction.

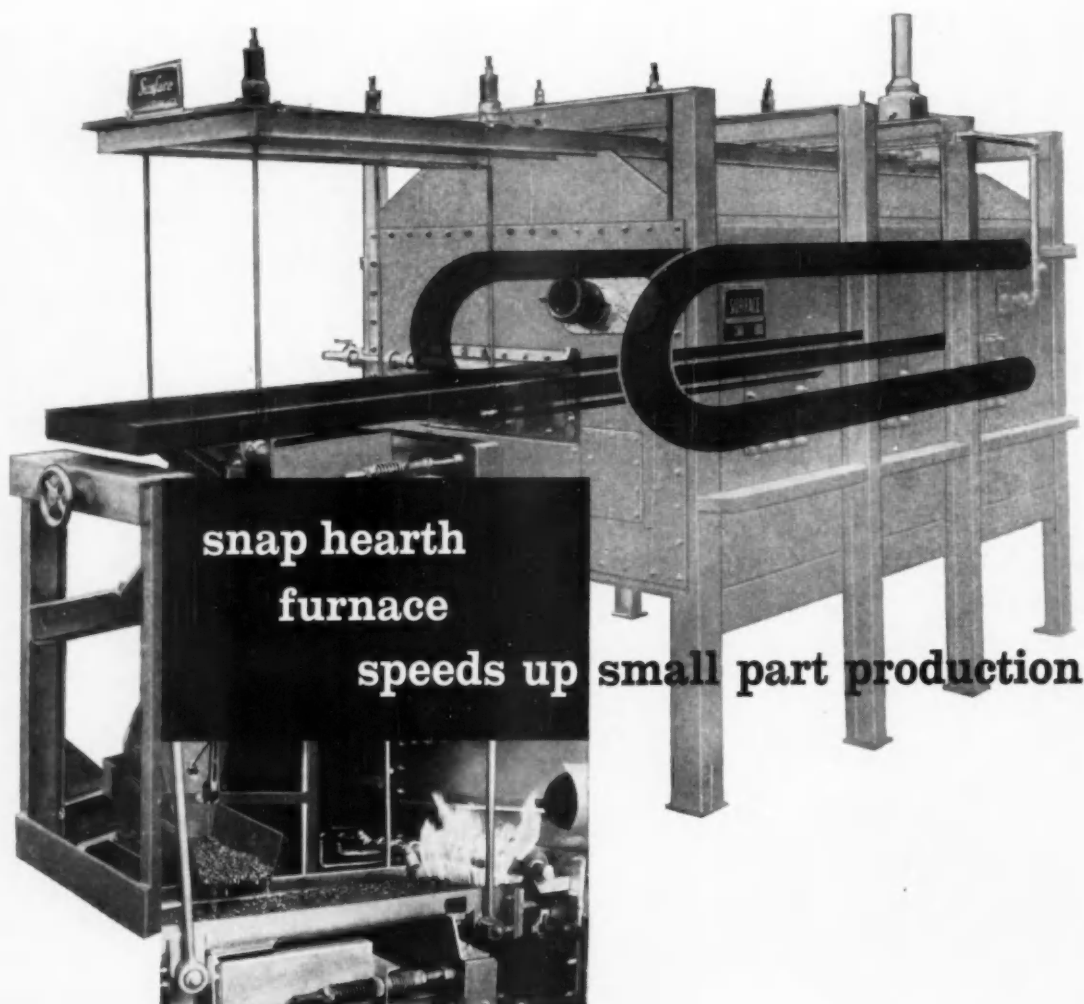
Caterpillar Tractor Co. uses Youngstown quality steels in the construction of these powerful machines. Youngstown Alloy Steel for the gears of the steering and driving mechanisms help to provide durable, trouble free mechanical operations. Yoloy "M" Steel Plates, one of the Yoloy family of high strength steels, are used for structural strength, resistance to shock and abrasion and also for ease in forming and welding the many intricate parts in this type of fabrication.

Youngstown's Alloy and Yoloy Steels are produced in a variety of forms and qualities to meet your particular specifications. Our Service Engineers are available upon request to discuss your Alloy and High Strength steel problems—why not call them today.

## THE YOUNGSTOWN SHEET AND TUBE COMPANY

General Offices - Youngstown 1, Ohio  
District Sales Offices in Principal Cities





**snap hearth  
furnace  
speeds up small part production**

The quantity and quality of small parts can be increased by controlled atmosphere heating and quenching in this new Surface® Snap Hearth Furnace. Production rates up to 500 lbs/hr are attained in many plants.

This is the first suspended hearth furnace to use suction type radiant tube firing, which eliminates a muffle and its extensive replacement problems. Another important feature is the hearth, which snaps to move the parts a short distance at regulated intervals.

Combined with Surface atmosphere generating equipment, the Snap Hearth Furnace is especially efficient for clean hardening, dry cyaniding, carbon restoration.

*Write for Bulletin SC-173.*

Surface Combustion Corp., 2397 Dorr St., Toledo 1, Ohio. In Canada: Surface Industrial Furnaces, Ltd., Toronto, Ontario.

*wherever heat is used in industry*



# GIANT HANDLER



## HIGH-CAPACITY YALE TRUCK ASSURES SMOOTH AND SAFE HANDLING OF DIES

Yale offers a series of electric trucks with capacities up to 150,000 lbs. to meet metals industries' demands for specialized handling equipment. These Yale Trucks handle coils, dies, sheet metal, and other heavy loads with maximum efficiency. Every feature that promotes greater handling speed and safety is built into these powerful Yale Trucks. For example, Yale's speed control assures smooth acceleration, protects driver and load from repeated handling shocks...power steer and a short turning radius mean extra ease when spotting

loads and greater maneuverability in congested areas...dual drive controls (optional) allow operation from either side of the truck, thus providing full visibility under all working conditions.

Find out how Yale Trucks can speed the movement of materials, increase production—send coupon below.

**To meet the need of expanding industries for better materials handling methods, look to Yale for advances in research, engineering, manufacturing, sales, service—as**

**YALE BUILDS FOR THE NEW ERA**

# YALE<sup>®</sup>

\*REG. U. S. PAT. OFF.

### INDUSTRIAL LIFT TRUCKS AND HOISTS

Gasoline, Electric & LP-Gas Industrial Lift Trucks • Worksavers  
Warehouses • Hand Trucks • Hand and Electric Hoists

AUTOMOTIVE INDUSTRIES, August 15, 1957

#### MAIL THIS COUPON TODAY

The **YALE & TOWNE** Manufacturing Co., Dept. A-78  
Roosevelt Boulevard, Philadelphia 15, Pa.  
Please send me Yale's booklet "Giant Handlers For The Metals Industries".

Your Name \_\_\_\_\_

Firm Name \_\_\_\_\_

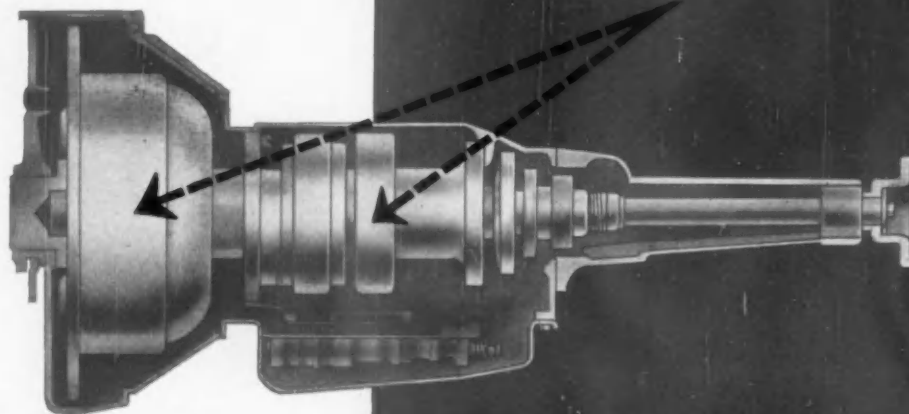
Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

In Canada: write The Yale & Towne Manufacturing Co.  
St. Catharines, Ontario, Canada



# What a difference a "D" makes...



IN SPRAG-TYPE CLUTCHES  
FOR AUTOMATIC TRANSMISSIONS

Automotive design demands component parts be stronger, lighter and smaller. Terms such as high capacity—less space—lightweight are familiar to automotive engineers and designers. These requisites are met by Formsprag for all automotive over-running clutch applications. With the Formsprag patented D-shaped sprag, a full complement of sprags may be used resulting in "higher capacity", "less weight" and "less space" than with any other type of over-running clutch.

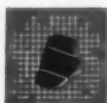
In addition, D-shaped sprags are self-spacing, act independently and share the load equally. Moreover they allow insertion of a *full complement* of sprags in

far less space. So, more engine torque can be transmitted per cubic inch of clutch displacement with Formsprag than by any other type of over-running clutch.

Formsprag's basically simple design permits economical prototype manufacture.

Automotive and aircraft manufacturers who demand the ultimate in over-running clutches specify Formsprag. Why not see for yourself what a difference a D makes. Next time you have a clutch application—specify Formsprag—world's largest exclusive manufacturer of over-running clutches.

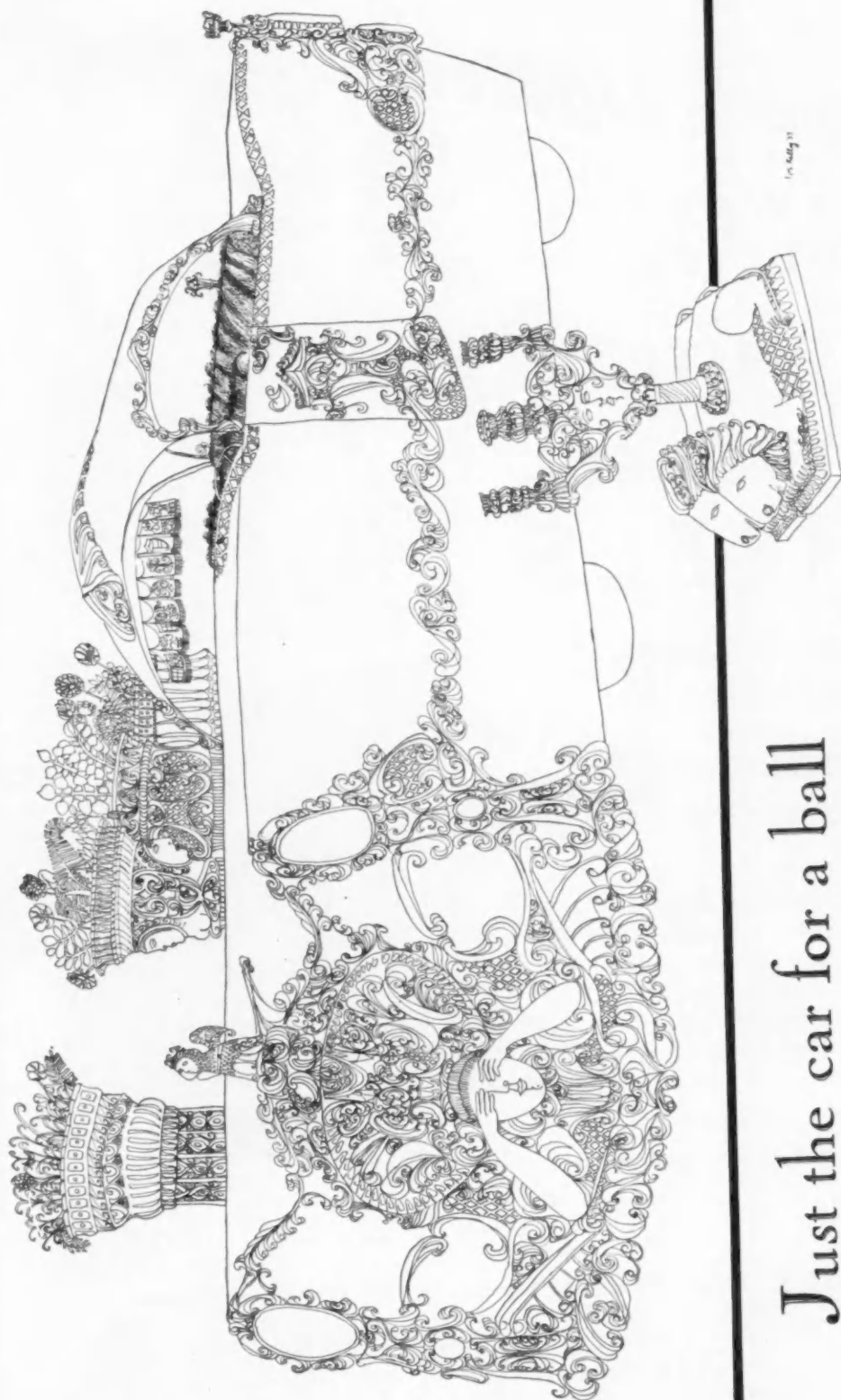
## FORMSPRAG COMPANY



23583 HOOVER ROAD, WARREN, MICHIGAN

*The only clutch that can give you full-complement performance.*

A-13-8C



## Just the car for a ball

Those who design for the public taste sometimes feel that the above vehicle is what people want to ride in on that big night out . . . with ermine, top hats, tiaras and gold-knobbed canes.

The limousine is phantasy, of course, but there's nothing chimerical about the tasteful, gleaming Stainless Steel you see on *all* cars. Stainless trim is as durable and practical as anything can be. It resists denting and corrosion far better than any

other metal, retains its luster indefinitely. Remember, too, that Stainless trim is often cheaper to fabricate than plated parts.

United States Steel sells just about any kind of Stainless you would ever want. But if instead of buying something, you'd like a free gift, write for a jumbo reproduction of the filigreed phaeton shown above. Address United States Steel, Room 2801, 525 William Penn Place, Pittsburgh 30, Pa.

*Drawing by Marie Tuicillo Kelly.  
Reproductions available on request.*



# USS STAINLESS STEEL

# *Stronger! Lighter!*

**ALWAYS  
SPECIFY**

**GUNITE**

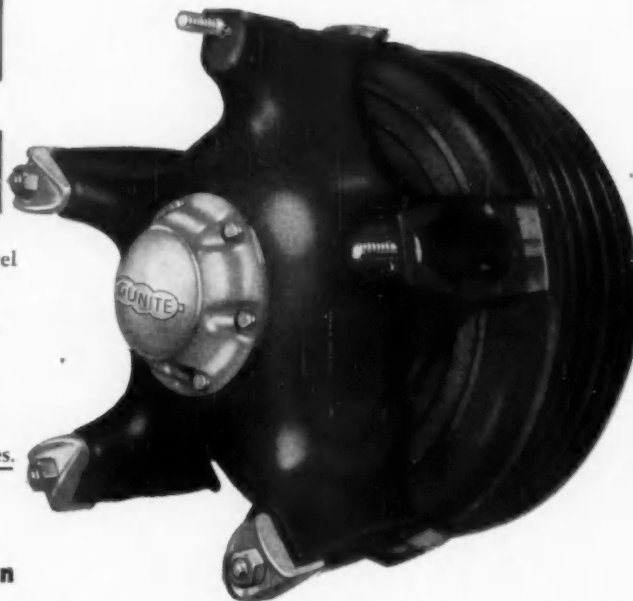
## **CAST-STEEL WHEELS**



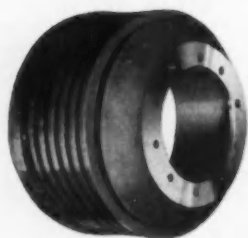
**FOR NEW EQUIPMENT**

**FOR CHANGEOVERS**

Many leading fleet engineers specify Gunitite Cast-Steel Wheels on all their heavy trucks and trailers . . . for good reason too! Gunitite wheels are rugged . . . yet lightweight. Minimum unsprung weight increases payload . . . increases income. Compare weight with other wheels. Save with Gunitite! Gunitite wheels fit both tubeless and conventional tires.



**Call Your Gunitite Distributor  
or Write for Complete Information**



**GUNITE**

**BRAKE DRUMS for Trucks, Trailers and Buses**

Gunitite Drums offer you more miles of safe, sure stops. Ribbed design minimizes flexing, dissipates heat faster and resists checking. Write for information or see your Gunitite Distributor.

# **GUNITE**

**FOUNDRIES  
CORPORATION**  
*Established 1854*

**ROCKFORD, ILLINOIS**

## SYSTEMS

1



BASIC "150" assemblies housed in either vertical mobile cabinets or separate portable cases are available in 1-, 2-, 4-, 6- and 8-channel models. Each is equipped with driver amplifiers of current feedback design and regulated power supplies for *each* channel, and a recorder featuring *nine* extremely accurate paper speeds on 2- to 8-channel models, five on single channel units. Appropriate plug-in preamplifiers quickly and efficiently equip a basic assembly for recording virtually any 0-100 cps phenomena.

new 6- and 8-channel analog readout systems

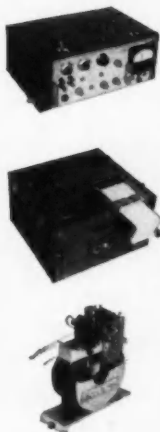
In addition, complete Sanborn systems from 2- to 8-channels are available for recording analog computer outputs. These are equipped with dual-channel DC amplifiers, for single-ended or push-pull signals — input impedance 5 megohms each input lead to ground — drift less than 0.5 mm/hr. — frequency response down 2 db at 60 cycles for all amplitudes to 4 cm peak to peak. Newest of the computer readout recorders are the 6- and 8-channel console systems (8-channel illustrated — "A" at left). The Model 183 Programmer in a Model 184 case ("B" at left) is optional for use with the 6- and 8-channel consoles. The Programmer automatically turns on chart drive, feeds calibrated signals to all channels, reads computer DC levels, determines the length of record, and shuts off the paper drive.

# SANBORN

## oscillographic recording equipment

3

## UNIT INSTRUMENTS



All Sanborn Preamplifiers and Recorders, as well as various other units, are available separately for specialized applications or use as "original equipment" in other apparatus. Instruments include the Model 150-300/700 Wide Band Driver Amplifier and Power Supply, for use with low power galvanometer elements, a 'scope and/or panel meter. When equipped with suitable "150" preamplifier, this amplifier provides a portable indicator for strain, force, pressure, temperature, AC watts, audio level, etc. Other units include the Model 150-1900 Master Oscillator Power Amplifier; Model 150-3100 Triplexer; Model 601 and 602 galvanometers; Model 150-2900 Dual-Channel DC Amplifier.

2

## PREAMPLIFIERS

A choice of *twelve* "150 Series" plug-in preamplifiers is now available, to equip systems for any of numerous recording problems. Improved control of input signals results from attenuator ratios of 1, 2, 5, etc., and calibrated zero suppression on AC-DC, Carrier, and Low Level DC Coupling, Frequency Meter, and Chopper Stabilized DC models. Other "150" preamplifiers include: Servo Monitor, Log-Audio, AC Wattmeter, RMS Volt/Ammeter, 400 cycle Frequency Deviation, and Triplexer.

Added to these three aspects of Sanborn Oscillographic Recording Equipment are the basic advantages of inkless recording in true rectangular coordinates, to provide accurate, easily interpreted records; high torque galvanometer (10 ma develops 200,000 dyne cm.); one percent linearity resulting from current feedback driver amplifiers and high torque galvanometers (maximum error is 1/4 mm in middle 4 cm of chart, 1/2 mm across entire chart); controls for timing, manual and remote coding.

Take advantage of the scope and flexibility of Sanborn equipment to answer your recording requirements. Sanborn engineers will be glad to provide further information and application assistance whenever you wish. Contact your local representative or write to the main office below.

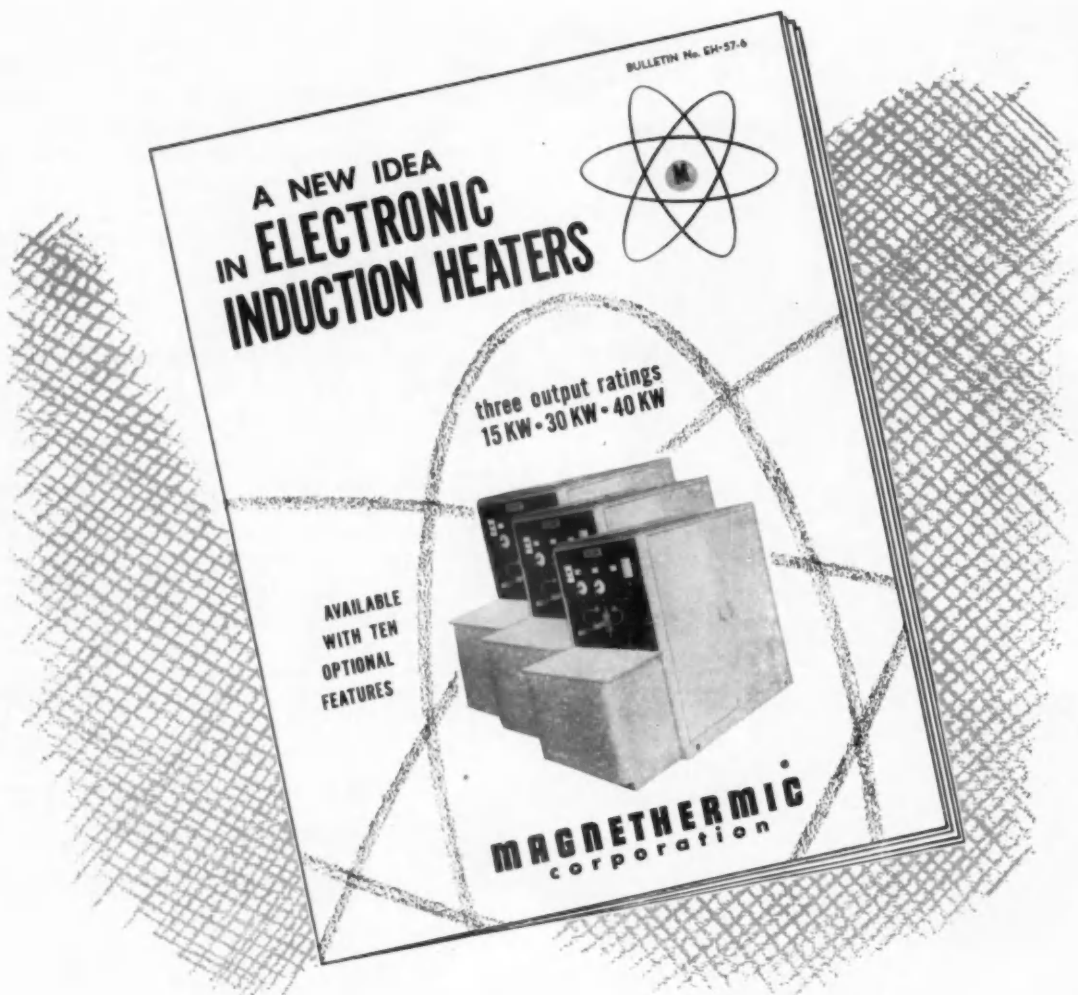
## SANBORN COMPANY

INDUSTRIAL DIVISION

175 WYMAN ST.

WALTHAM 54, MASS.





## New Approach to Electronic Induction Heaters

For the first time, an electronic induction heater can be pinpointed to specific conditions or operation—literally a custom design at reasonable cost.

No two induction heating processes are the same. For optimum performance, each induction heater should be hand tailored to the job. The Magnethermic plan of adding optional features to a standard heater results in a custom design at low cost. Magnethermic's "building block" principle for electronic induction heaters provides the flexibility needed for low unit cost.

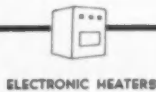
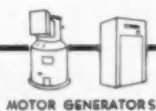
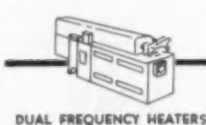
Here are a few of the optional features which can be added to the standard heater:

- Built-in Output Transformer
- Stepless Thyatron Power Control
- Built-in Water Cooling System
- Dust-proof Cabinet and Air Cooling System

All ten optional features and the standard heater are detailed in this new bulletin, available upon request. The bulletin contains ratings, specifications, and such useful data as a frequency selector chart, surface hardening table.

Heaters available from stock in three ratings—15 KW, 30 KW, 40 KW output.

Address your electronic induction heater inquiry to Magnethermic, Youngstown, Ohio.  
New Bulletin EH-57-6 available upon request.



**Now...  
both kinds  
of Friction  
Engineering!**

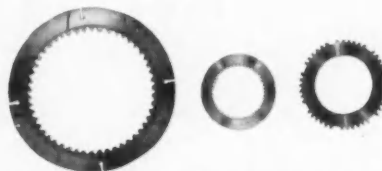


**CALL IN** *American Brakeblok*

**TO GET THE JOB DONE BETTER, FASTER!**



All types of organic friction materials, including light- and heavy-duty brake linings and thick blocks, clutch facing and special products for industry.



Sintermet—sintered metallic friction materials for transmission and clutch applications in the automotive, aircraft and industrial fields.

**STOP or GO**—American Brakeblok can help solve both brake and clutch or transmission problems with a full line of friction materials. Sintered metal products, as well as organic, are backed by the full resources of American Brakeblok to provide better answers, faster.

**Research:** Your particular problem may be solved already by one of the hundreds of formulas now on our shelves.

**Testing:** Continuous lab and road evaluation of all factors of performance and service life can shortcut your own testing time.

**Production:** Precise, point-by-point production of three modern plants can meet the needs of millions of vehicles and machines.

**Service:** Our application engineers work hand in hand with your project team—eliminate lost hours when design changes call for new requirements.

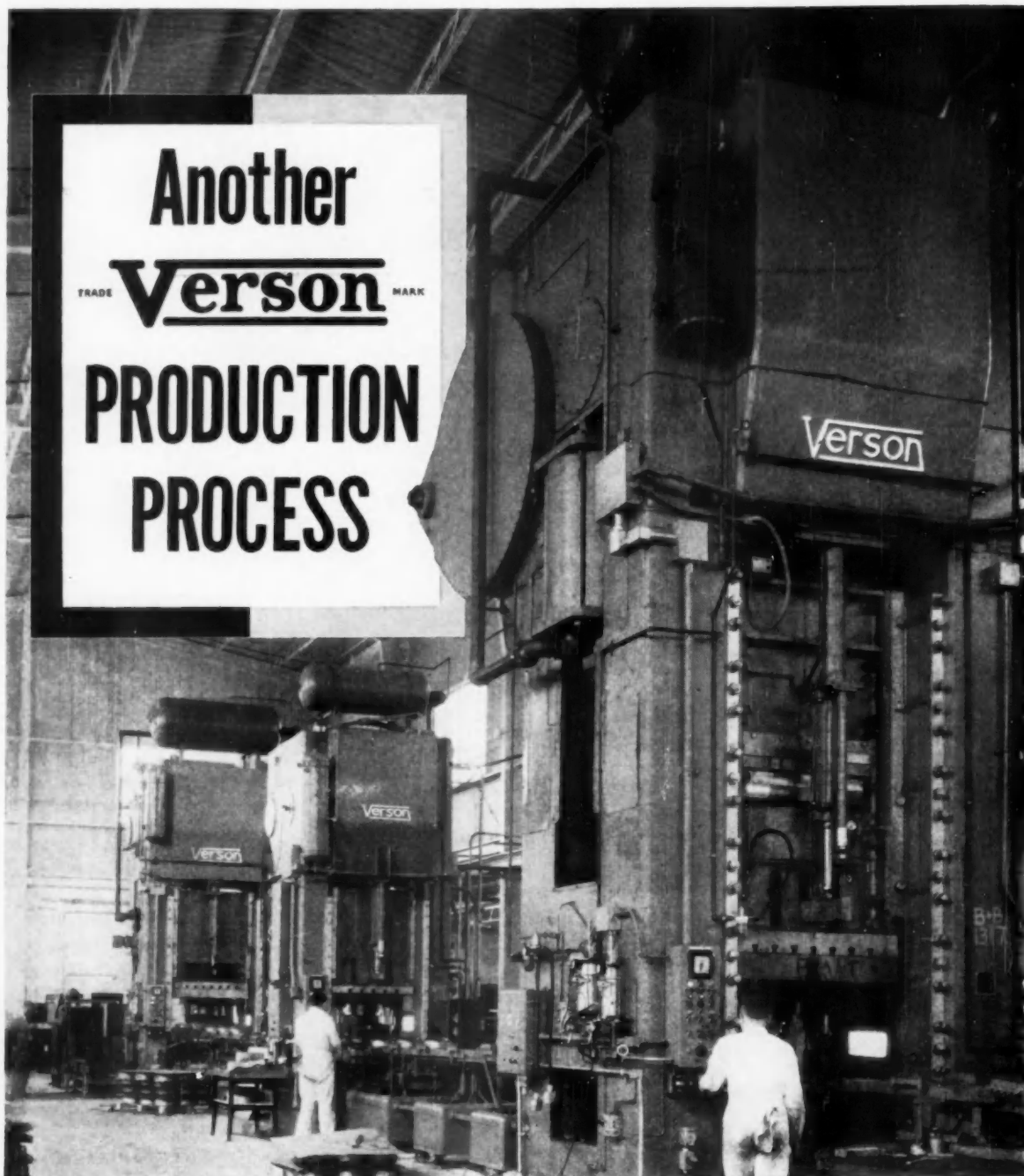
To take full advantage of these American Brakeblok facilities, we suggest you check with us during initial planning stages. A call or letter will bring quick action.

**Brake Shoe**

**AMERICAN BRAKEBLOK DIVISION**

**DETROIT 9, MICHIGAN**

# Another **Verson** PRODUCTION PROCESS



Engineered and Developed by **-Verson-** to Make Manufacturing More Profitable

Here is a good example of what Verson engineering can do in automated press lines . . . and this is no theoretical concept . . . it is a tried and proven production process which has been in operation for one year.

Three Verson Eccentric Presses (1500, 200 and 600 tons respectively from front to rear in above photograph) are synchronized with automatic transfer and

feeding equipment. The part produced is an automotive transmission drive housing.

As a manufacturer of both Transmat and automated press line processes and related tooling, Verson is well qualified to assist you in high production automatic stamping problems. For specific recommendations send an outline of your requirements.

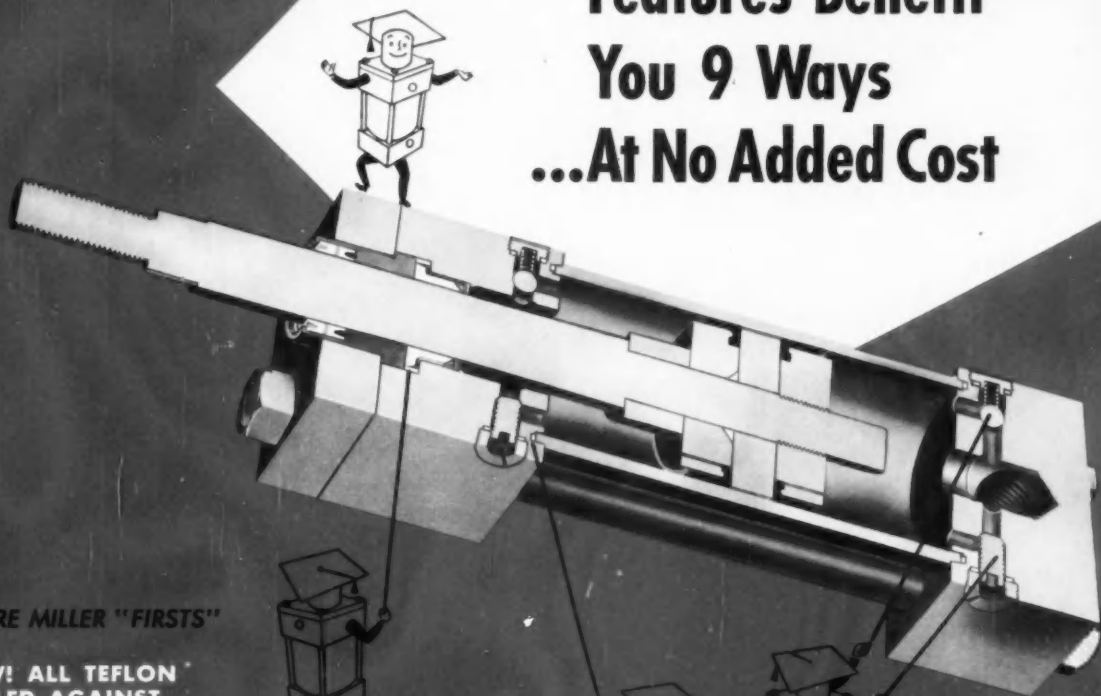
163

**VERSON ALLSTEEL PRESS CO.**

9307 S. Kenwood Ave. • Chicago 19, Illinois  
8300 S. Central Expressway • Dallas, Texas



# 4 New Hydraulic Cylinder Features Benefit You 9 Ways ...At No Added Cost



## MORE MILLER "FIRSTS"

### NEW! ALL TEFLON<sup>\*</sup> SEALED AGAINST EXTERNAL LEAKAGE...

1. Eliminates Seal Damage from Fluids—Teflon is Impervious to all Hydraulic Fluids (Including Fire-Resistant Types) . . . Hydraulic Cylinders with Teflon Piston Cups Slightly Higher.
2. Eliminates Seal Damage from High Temperatures—Teflon Sealed Cylinders Operate At —100° F. to 500° F.

### NEW! ROD BUSHING SEAL...

1. Eliminates Shearing of "O" Ring in Re-Assembly
2. Eliminates Extrusion of "O" Ring at Extreme Pressures.

### NEW! SHEF SEAL AT TUBING ENDS...

1. Eliminates Shearing of "O" Ring in Re-Assembly
2. Eliminates Extrusion of "O" Ring at ANY Pressure—Teflon Sealing Ring is Backed Up by Zero Clearance Metal Shoulder.

### NEW! LOCK-SEAL CUSHION ADJUSTMENT SCREW...

1. Eliminates Screw Projection Beyond Head and Cap—Cylinders Mount on Any Side.
2. Eliminates Manual Sealing and Locking After Flow Adjustment—Teflon Seal is Self Regulating and Self Locking.
3. Eliminates Accessibility Problems—Cushion Screw Interchangeable with Ball Check Position—Adjustable Through Small Wrench Hole Drilled in Interfering Machinery.

\*du Pont trademark for its tetrafluoroethylene resin

Copyright 1957—Flick-Reedy Corporation

Turn Page For Cross Section Of SHEF SEAL



#### OTHER MILLER QUALITY FEATURES

- Case-Hardened Chrome Plated Piston Rod
- Rust Resistant Surfaces
- Teflon Oil and Dirt Wipers
- Interchangeable Square Design



**FLUID POWER DIVISION**  
FLICK-REEDY CORPORATION

2028 N. Hawthorne Ave. Melrose Park, Ill.

AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS  
COUNTERBALANCE CYLINDERS • BOOSTERS





## Announces a New Space and Price Saving Hydraulic Cylinder Line

MORE MILLER "FIRSTS"



## Announces 50% More Power Per Cylinder Dollar

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## SAVE UP TO 76% OF COST

Heavy Duty Model LH—Same Size As Ordinary  
Gasket Type Square Design Low Pressure Cylinders

BORE	NORMAL RATINGS	NON-SHOCK INTERMITTENT RATINGS	YOU SAVE THIS % IN PRICE OVER STANDARD 2000-3000 PSI CYLINDERS
1 1/2"	1500 PSI	2500 PSI	27%
2	1500	2500	27%
2 1/2	1000	1500	28%
3 1/4	1500	2500	32%
4	1000	1500	35%
5	800	1200	37%
6	800	1200	43%
8	500	800	50%
10	500	800	71%
12	500	800	76%
14	500	800	Not Available in 2000-3000 PSI

with Extra Heavy Duty

3000-5000 PSI MODEL H

## HYDRAULIC CYLINDERS

Same Price  
and Mounting Dimensions  
as Miller 2000-3000 PSI  
Hydraulic Cylinders.



BOTH LINES  
MADE POSSIBLE BY  
SHEP SEAL

**Miller** - FLUID POWER DIVISION  
FLICK-REEDY CORPORATION

### OTHER MILLER QUALITY FEATURES

- All Teflon Sealed Against External Leakage—Teflon Cups Extra
- Case-Hardened Chrome Plated Piston Rod
- Shear Proof Rod Bushing Seal
- Ball Check Interchangeable with Self Sealing and Locking Cushion Adjustment
- Rust Resistant Surfaces
- Teflon Oil and Dirt Wipers



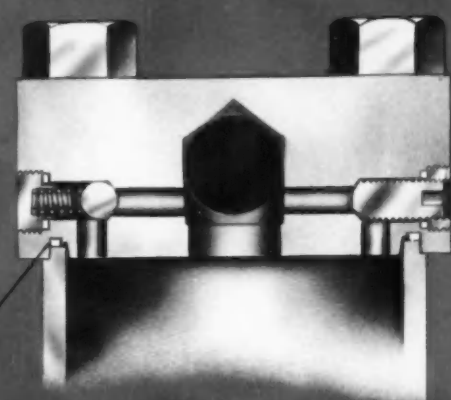
AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS  
COUNTERBALANCE CYLINDERS • BOOSTERS



# SHEF SEAL Obsoletes All Other Hydraulic Cylinder End Seals . . . at no added cost

## HAS EVERY ADVANTAGE

1. Pressure Energized—Sealing Effectiveness Increased with Pressure.
2. Zero Metal-To-Metal Clearance at all Pressures Gives You Perfect Seal Backup. Sealing Ring Cannot Extrude.
3. Simplified Servicing. No "Blind" Assembly. Sealing Ring Cannot Shear.
4. Teflon® Sealing Ring Withstands All Hydraulic Fluids at Temperatures from -100° F. to 500° F.
5. Head and Cap Axial Movement Does Not Destroy Sealing.
6. Allows Air Bleed In Head and Cap for Remote or Automatic Bleeding.
7. One Sealing Ring Cross Section Dimension For All Cylinder Sizes—Supplied On Convenient Spools.
8. Zero Metal Backup Clearance Eliminates Dangerous Leaks and Spurts of Fluid Due To Seal Failure.

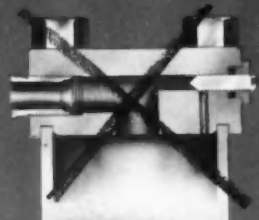


**SHEF SEAL**

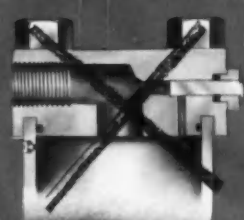
## NONE OF THESE DISADVANTAGES

### GASKET CONSTRUCTION

1. Unpredictable Results—Leaks and Blows Even at Low Pressures.
2. Outlawed by J.I.C. Eight Years Ago.
3. Seal Failure Causes Dangerous Leaks and Spurts of Fluid. Creates Unnecessary Fire and Safety Hazard.



**GASKET**



**"O" RING**

### "O" RING CONSTRUCTION

1. High Pressures and Shock Loads Expand Tubing—Increase Clearance and Cause Extrusion.
2. Blind Assembly Can Shear Sealing Ring—Difficult Servicing.
3. Seal Failure Causes Dangerous Leaks and Spurts of Fluid. Creates Unnecessary Fire and Safety Hazard.
4. Requires Large Inventory of "O" Rings  
—For Servicing Variety of Cylinder Bores.  
—For Special Synthetic Rubber Compounds To Meet Ever Changing Fluid and Temperature Needs.

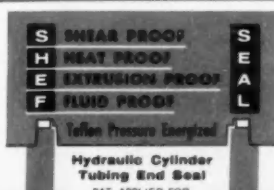


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**When you buy Miller ... You buy extra years  
of worry-free Cylinder performance**

**...at competitive prices**

**SHEF SEAL—Another Miller "First"**



- OTHER MILLER QUALITY FEATURES**
- All Teflon Sealed Against External Leakage—Teflon Cups Extra
  - Case-Hardened Chrome Plated Piston Rod
  - Shear Proof Rod Bushing Seal
  - Ball Check Interchangeable with Self Sealing and Locking Cushion Adjustment
  - Rust Resistant Surfaces
  - Teflon Oil and Dirt Wipers



Turn Page For More About MILLER



## All Teflon Sealed —Perfect Sealing for Hydraulic Cylinders

### HAS EVERY ADVANTAGE...

#### Teflon—As Static and Dynamic Seals

1. Impervious to Every Hydraulic Fluid Including Fire-Resistant Types.
2. Seals Perfectly in Cylinders at Temperatures from  $-100^{\circ}\text{F.}$  to  $500^{\circ}\text{F.}$
3. Can Be Molded Into Shapes That Have Zero Leakage—Hold Pressure Indefinitely.
4. With Proper Design of External Seal Cavities, Teflon Can Be Included Without Increasing Prices. Miller Provides Teflon for all External Seals at Prices Competitive with Ordinary Cylinders. Leather Internal Piston Cups are Standard (Teflon Cups Extra).

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Printed in U.S.A.

\*du Pont trademark for its tetrafluoroethylene resin.



## NONE OF THESE DISADVANTAGES

### Synthetic Rubber—

#### As Static and Dynamic Seals

1. Unsatisfactory Except When Used With A Limited Range of Hydraulic Fluids.
2. Even Uncontrollable Changes in Fluid Additives Often Destroy Seal.
3. Specific Compounds Needed for Compatibility with Specific Fluids Normally Used Today.
4. Normal Temperature Range Limited to  $0^{\circ}\text{F.}$  to  $130^{\circ}\text{F.}$  Slightly Reduced Life When Operated at  $130^{\circ}\text{F.}$  to  $150^{\circ}\text{F.}$  Greatly Reduced Life at  $150^{\circ}\text{F.}$  to  $250^{\circ}\text{F.}$
5. External Leakage Causes Fire and Safety Hazards When Temperature or Fluid Destroys Seals.
6. "U" Type Seals Without Mechanical Retainer at Mid-Section Frequently "Roll" and Lose All Sealing Ability.

### Resin Impregnated Leather—

#### As Dynamic Seals Only

1. Is Compatible with Many—But Not All—Hydraulic Fluids and Additives including a few Fire-Resistant Types.
2. Normal Temperature Range Limited to  $-60^{\circ}\text{F.}$  to  $130^{\circ}\text{F.}$  Slightly Reduced Life When Operated at  $130^{\circ}\text{F.}$  to  $150^{\circ}\text{F.}$  Substantially Reduced Life at  $150^{\circ}\text{F.}$  to  $250^{\circ}\text{F.}$
3. External Leakage Causes Fire and Safety Hazards When Temperature or Fluid Destroys Seals.  
Miller Uses Leather Piston Cup Seals for Internal Sealing... Standard Price (Teflon Cups Extra).

### Piston Rings—

#### As Dynamic Internal Seals

1. Most Piston Rings Allow Some Leakage.
2. Allow "Slip" or "Drift" of Piston Due To Leakage—Unsatisfactory for Many Applications.
3. Allow Varying Feed Rates Due To Leakage Because Of Viscosity Change During Startup—Unsatisfactory for Most Multiple and Automated Operations.
4. Allow Some Pressure Loss.
5. Chips and Dirt Enter Space Between Piston and Tube Causing Scoring—Especially During Startup.

## All Teflon Sealed—Another Miller "First"

### OTHER MILLER QUALITY FEATURES

- All Teflon Sealed Against External Leakage—Teflon Cups Extra
- Case-Hardened Chrome Plated Piston Rod
- Shear Proof Rod Bushing Seal
- Ball Check Interchangeable with Self Sealing and Locking Cushion Adjustment
- Rust Resistant Surfaces



2028 N. Hawthorne Ave. Melrose Park, Ill.



- Shear Proof Rod Bushing Seal
- Ball Check Interchangeable with Self Sealing and Locking Cushion Adjustment
- Rust Resistant Surfaces
- Teflon Oil and Dirt Wipers



## How Mayari R thwarts corrosion in these refuse loaders

Ashes, rubbish, garbage, boxes, crates, even Christmas trees — all are gobbled up and chewed to a pulp inside the cavernous bodies of these welded Roto-Pac refuse loaders. What a happy hunting ground for corrosion and abrasion!

City Tank Corporation, Corona, L. I., N. Y., makers of Roto-Pacs, stave off corrosion and abrasion by building the sides, roof and floor of the body with Mayari R high-strength, low-alloy steel. Mayari R resists abrasion substantially longer than carbon steel, and has five to six times greater resistance to atmospheric corrosion. It also welds just about as easily as carbon steel.

These three properties have led many vehicle manu-

facturers to take advantage of Mayari R in building their product. So has its high yield point (50,000 psi for material up to and including  $\frac{3}{4}$  in. in thickness) which permits the use of lighter structural members for sizable reductions in deadweight.

Catalog 353 contains important technical data on Mayari R, as well as scores of illustrated case histories on specific Mayari R applications. If you would like to have a copy, just telephone or send a letter to the nearest Bethlehem district sales office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem  
Pacific Coast Steel Corporation  
Export Distributor: Bethlehem Steel Export Corporation



## Mayari R...High-Strength, Corrosion-Resisting Steel



(Advertisement)

## Resistance Welding Structural Members

**SCI AKY**HELPS PUT PROFIT  
INTO MANUFACTURINGHow Massey-Harris-Ferguson Achieves  
Mass Production Economy on Short Runs

Among manufacturers whose production requirements for any given part are limited, resistance welding is often regarded as an impractical method of fastening. They agree it is fine for mass production where tooling costs and setup time can be spread out over tens of thousands of parts. But for them, the cost of tooling and fixturing anything but the simplest assemblies would be uneconomical.

The Cost Research Department of Massey-Harris-Ferguson, as part of a program to reduce manufacturing costs, undertook an investigation of resistance welding. Under the direction of Mr. E. E. Hart, the investigation emphatically proved the economy and dependability of the process for a wide range of limited production assemblies.

## Simplification of setup is key

The Cost Research Department reasoned that the key to the entire problem depended entirely on minimizing setup time, complete simplification of tooling and fixturing and positive dependability and consistency of the fabricating method. Mr. Hart was convinced proper resistance welding techniques would satisfy all these requirements. Subsequent developments and testing proved him right.

## How the problem was solved

Basic tooling and fixturing was built right into the welder. (See Figs. 1 and 2.) The various assemblies required

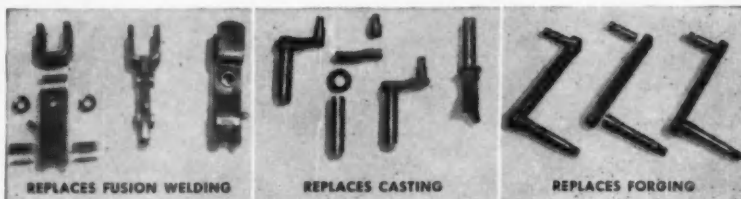


Fig. 3 Typical assemblies resistance welded on Sciaky equipment at M-H-F.

only the simplest tooling. Individual tooling for any assembly seldom cost as much as \$75 per welding setup.

Setup time for any assembly was reduced to an average of 30 minutes. The performance of the welders themselves was carefully studied and recorded. Machine control setup for any assembly was reduced to a simple matter of the briefest reference to graphs.

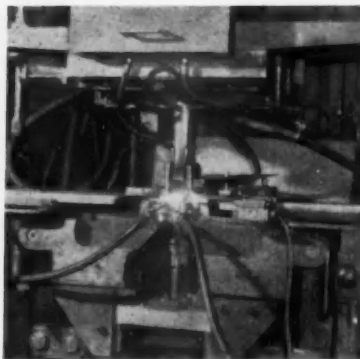


Fig. 2 Note universal fixturing table and simple dies used for welding a yoke assembly.

## Cost reductions achieved

The large number of assemblies fabricated by resistance welding include many structural members. Castings, forgings and arc welded assemblies have been replaced with resistance welded assemblies of standard sheet or bar stock and screw machine products.

The cost of the resistance welded part averages 10 to 40% less than similar arc welded parts. The savings in time of the welding operation itself averages 60 to 90%. Castings and forgings suffer in comparison, with savings of over a dollar per unit not unusual.

## Quality welding essential

The success of such a program requires that the welders be capable of producing consistently high quality welds with maximum ease of control setup. Sciaky patented three phase welders easily meet these requirements.

## Detailed information available

Two bulletins are available giving more complete information on the Massey-Harris-Ferguson program. "Resistance Welding at Work," Vol. 5, No. 1 (16 pages), gives data, including cost reductions, on 28 different M-H-F assemblies. An engineering report on "Design Standards" (48 pages) gives full technical data on the eight basic weld types employed. Copies of either or both bulletins are available on request.

Write today, mentioning the information you would like to receive. There is no obligation. Sciaky Bros., Inc., 4925 W. 67th St., Chicago 38, Ill. PORTSMOUTH 7-5600.

DO YOU HAVE A  
RESEARCH PROBLEM?

Facilities of the Sciaky Research Division at Los Angeles, California, are available for contract research to answer resistance welding problems. Housed in a 15,000 sq. ft. building, these facilities include an experienced engineering staff, a complete range of the most advanced resistance welding machines including the largest in the world and a laboratory equipped for metallography, chemistry, electronics, photography and testing as applied to resistance welding. Write for further information and ask for the 20 page Research Division brochure.

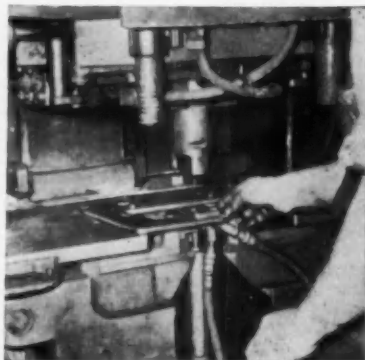


Fig. 1 Close-up of simple tooling required for a baler pick-up crank assembly.



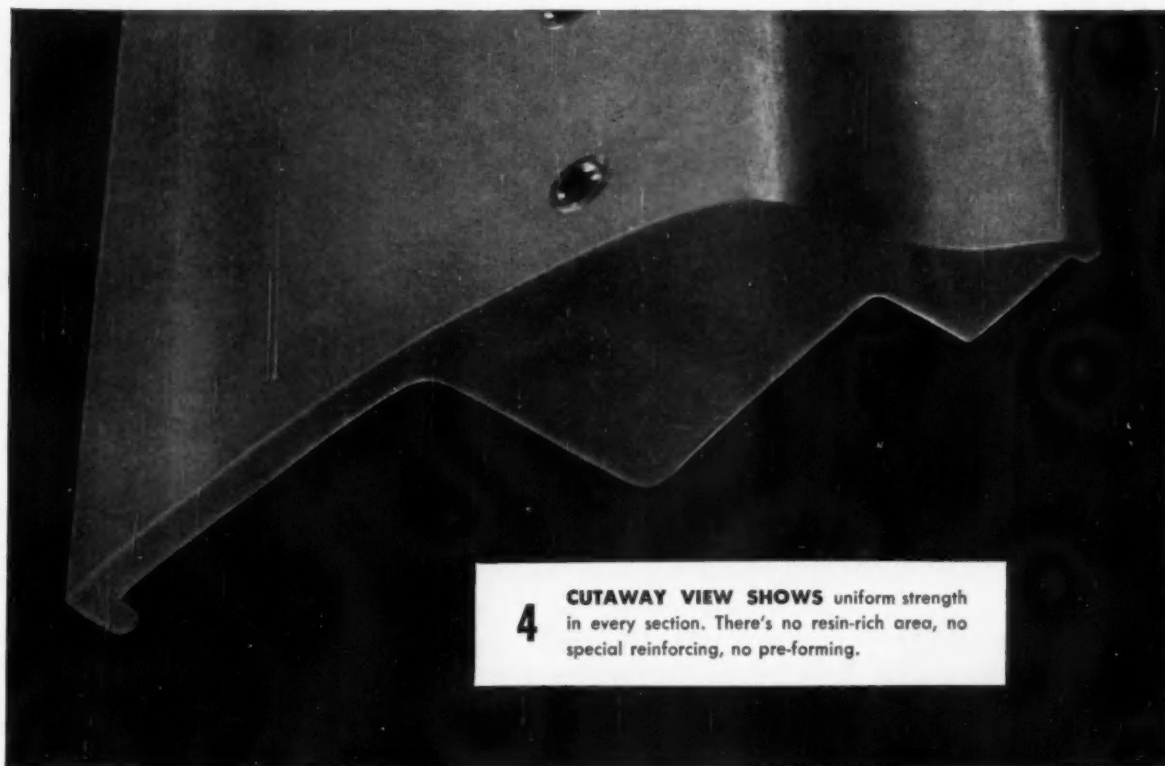
**1** This premix consists of reinforcing material, such as fiber glass or sisal, thoroughly mixed with polyester resin containing Dow Styrene.



**2** The premix molding compound flows evenly to each and every section of the closed die as it is compressed under heat and pressure.



**3** After a very short cycle, the finished premix molding is removed from the die. It is now ready for immediate assembly or shipment.



**4** **CUTAWAY VIEW SHOWS** uniform strength in every section. There's no resin-rich area, no special reinforcing, no pre-forming.

## For lower bids: premix moldings

*For uniform strength: polyester resin with Dow Styrene*

Many complicated parts—especially parts with varying wall thicknesses—are now made better, at lower cost, by premix molding. There are no resin-rich areas. Strength is uniformly distributed. Pre-forming is eliminated. And holes and nozzles can be molded in a part, eliminating punching and drilling operations.

Leaders of the automotive and appliance industries have

proved the benefits of premix moldings for specific parts. Many innovations are now on the drawing boards.

The product shown is an example of the many now being made by premix molding using Dow Styrene. For technical assistance on Dow Styrene, write THE DOW CHEMICAL COMPANY, Midland, Michigan — Plastics Sales Department PL1885G-3.

*Photographs through the courtesy of Fabricon Products, River Rouge, Michigan*

YOU CAN DEPEND ON

**DOW**

# *this ERIE press speeds extrusion*

Presses like this—made expressly to extrude graphite electrodes—are routine specialization for Erie Foundry Company. This 450-ton press is now performing in the field, in typical trouble-free Erie fashion, providing faster extrusion work. The bed plate, rigidly attached to the press, eliminates the need for lining-up at our customer's plant, and assures continued accurate alignment. Die changes can be made in a matter of minutes by removing the clamp nuts and separating the half clamps by cranking.

## **Smoother Tamping Action**

The operator controls the action of this Erie press smoothly and accurately by moving a hand lever in the same direction the ram travels. The further the lever is moved from vertical, the faster the ram travels . . . no other control valves are required. Fast advance and reverse speeds are achieved by auxiliary cylinders.

A similar carbon extrusion press rated at 2000 tons is now being assembled in the Erie Foundry Company plant. We invite you to see this press.

Erie Foundry Company would like to quote on your requirements. Please write

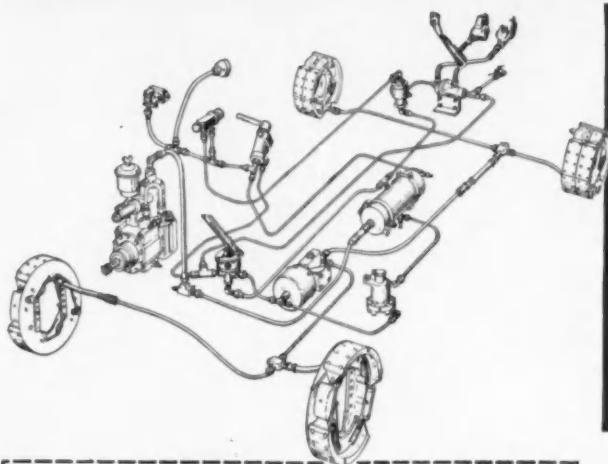
*Hydraulic Press Division*

**ERIE FOUNDRY CO. ERIE 5, PA.**



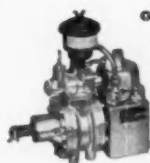
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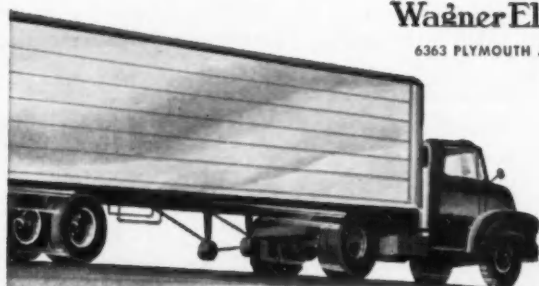
But get the whole story on Wagner Air-Over-Hydraulic Air Brakes for yourself—*first* in economy, reliability and maximum brake safety. Send for Catalog KU-201 that describes the performance and safety features you add to the trucks you manufacture by equipping them with Wagner Air Brakes.

K57-10

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psi minimum tensile strength.

Cleveland standard miniature screws are available from stock in both high quality heat treated alloy steel and nonmagnetic 18-8 stainless. Write today for prices and a copy of the Cleveland socket screw products folder.

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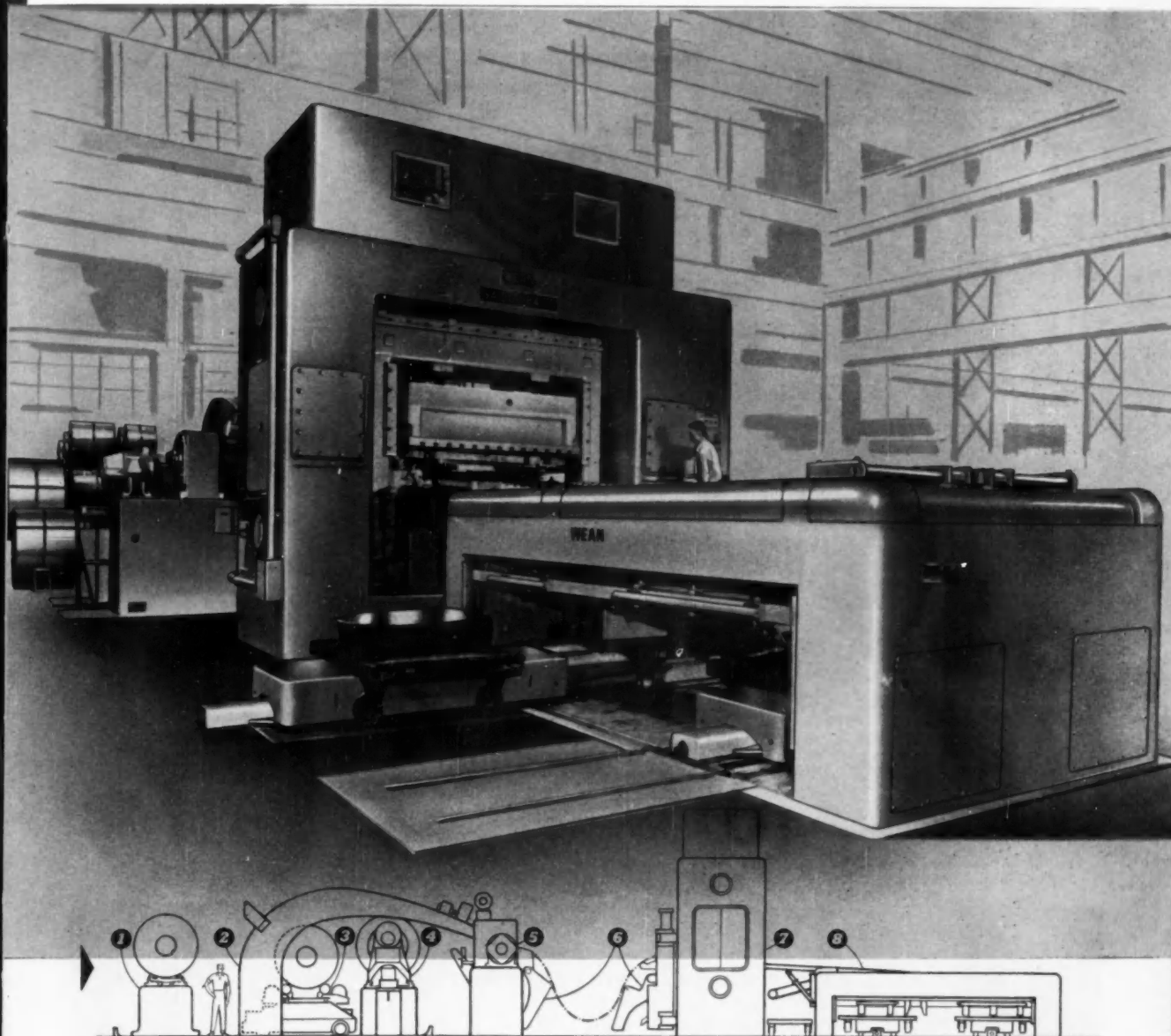
Socket head cap screws			Socket set screws, plain cup point		
Diameter	NC	NF	Diameter	NC	NF
#0.....	—	2.0	#0.....	0.5	0.5
#1.....	3.5	3.5	#1.....	1.5	1.5
#2.....	6.0	6.0	#2.....	1.5	1.5
#3.....	8.5	9.5	#3.....	5.0	5.0



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**250 ton press line**  
**quadruples production**  
**of large**  
**heavy gauge parts**

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Wean to work together as a single unit. Thus, the complete line is capable of producing at maximum press speeds. Consider, for a minute, how such production equipment can lower your per-unit manufacturing costs.

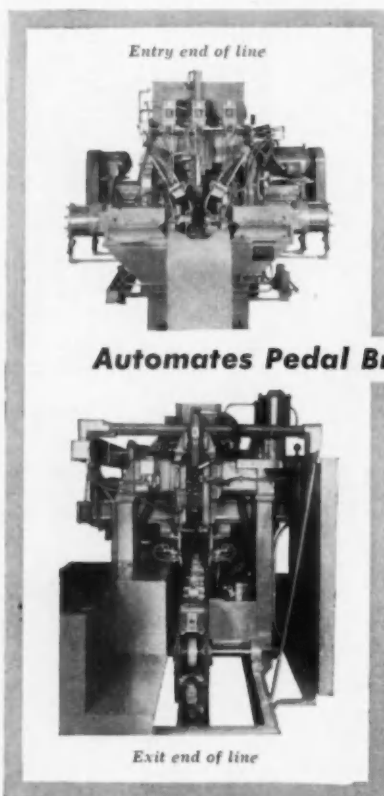
20 tons or 300 tons, whatever your press requirements, you will want the complete story on the "Flying-Press" and related units. Write today for your copy of the Wean "Flying-Press" Brochure.



**Wean**

Equipment Corporation

CLEVELAND 17, OHIO



# **Federal**

## **PACKAGED PRODUCTION LINE**

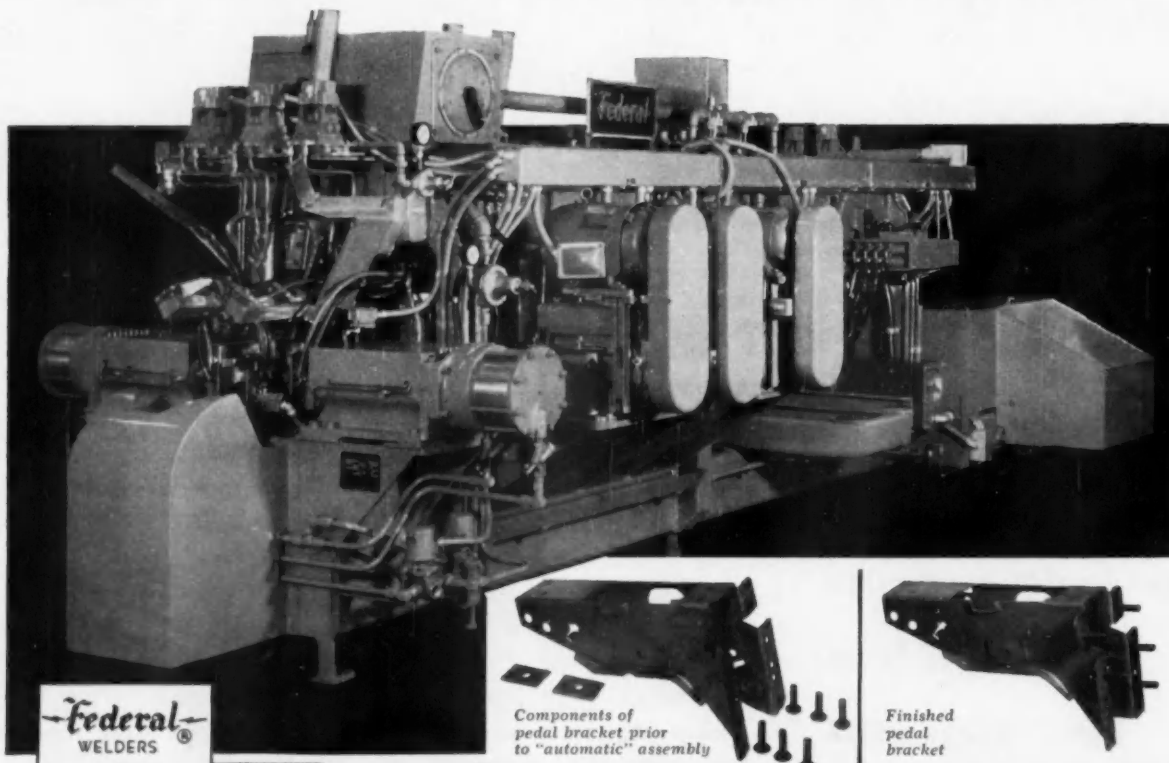
### **Automates Pedal Bracket Manufacture for Dodge!**

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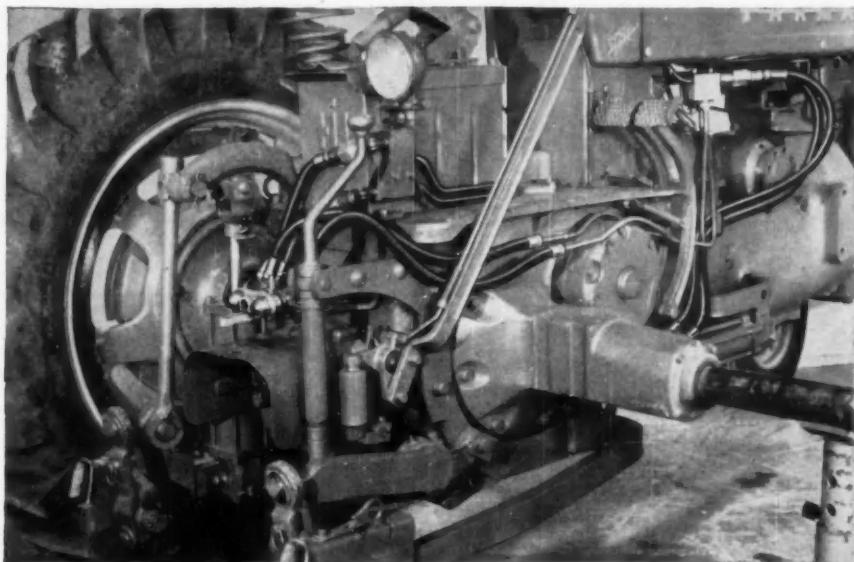
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**The Federal Machine and Welder Company**

**WARREN, OHIO**

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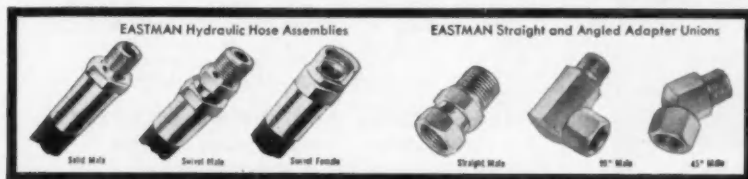
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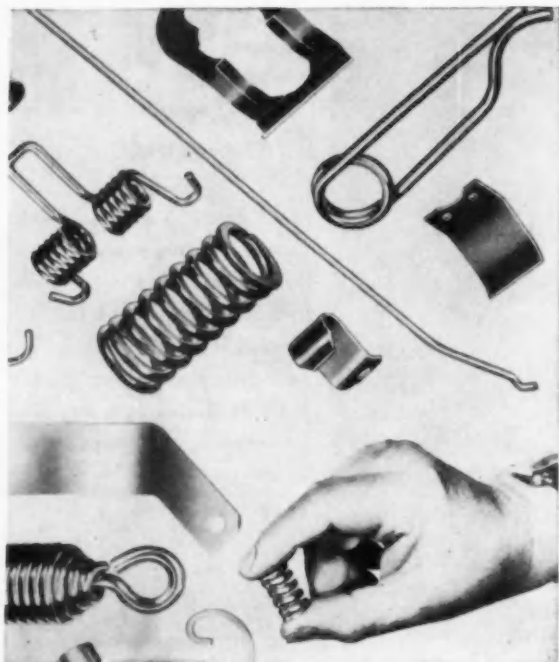


**HYDRAULIC POWER** permits raising right, left, or rear cultivator gangs separately, together, or any combination.



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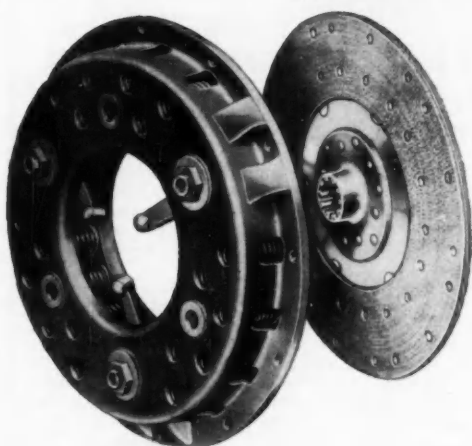
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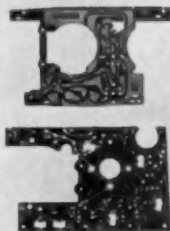
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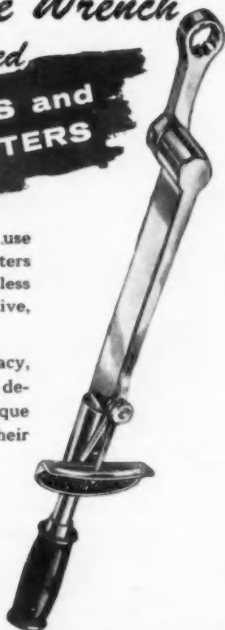
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LEAKS**

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**TRU-O-SEAL** Fittings are guaranteed to seal pipe thread connections permanently against all oils, practically all known chemicals and gases; to seal under high pressures or vacuum; to withstand -280° to plus 500° F.; to eliminate "overtightening" damage and pipe dope. Available in 1/8" to 2 1/2" pipe thread sizes.

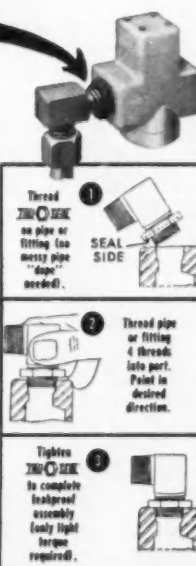
**\$10.00 Trial Offer No. 1:** eight 1/8", ten 1/4", eight 3/8", ten 1/2" pipe thread **TRU-O-SEAL** Fittings.

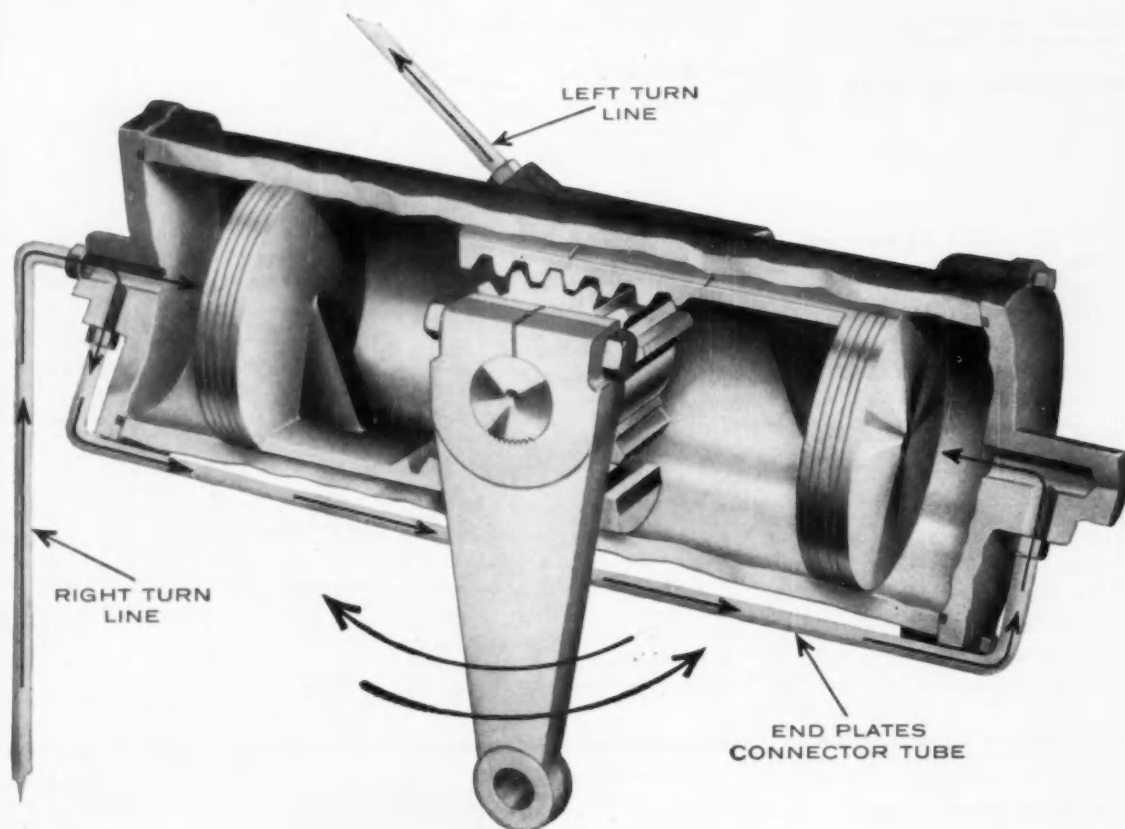
**\$10.00 Trial Offer No. 2:** eight 1/2", ten 3/4", four 1" pipe thread **TRU-O-SEAL** Fittings. Send order to

**TRU-O-SEAL**

**DIVISION**  
Flick-Reddy Corporation

2020 N. Hawthorne Melrose Park, Ill.  
"Miller Fluid Power" is also a Div. of Flick-Reddy Corp.





## Now...a new kind of Power Cylinder to help you cut costs

**T**HE new rotary motion Thompson Power Cylinder provides versatility of application, ease of installation, compactness and efficiency certain to solve many design and manufacturing problems. These features can cut your costs by simplifying production. It is now in use in a leading make of heavy-duty trucks.

Requiring a minimum of space, the Thompson Power Cylinder can be operated wherever hydraulic or pneumatic pressure is available. Operating from 600-1000 psi, at 700 psi it delivers approximately

26,000 inch pounds torque output. These parameters can be varied to obtain a custom installation. Also, over-running clutches, sprockets, gears, chains, etc., are easily adapted to the output shaft to further increase its versatility.

Precision engineered, the Thompson Power Cylinder is as dependable as it is versatile. You can count on a long, continuous, trouble-free life.

To learn more how the Thompson Power Cylinder can save you money in design, manufacture and installation costs, write for our free book-

let. Described are many of its diverse uses and additional benefits. Mail to Thompson Products, Inc., Michigan Division, 34201 Van Dyke Avenue, Warren, Michigan.

You can count on

**Thompson  
Products**

Michigan Division:  
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# NEW

NEW

NEW

ESPECIALLY DESIGNED FOR TOP RING  
GROOVE PROTECTION IN PISTONS  
FOR GASOLINE ENGINES

AN ECONOMICAL METHOD WITH  
MINIMUM WEIGHT INCREASE

CAN BE APPLIED TO ANY TYPE  
ALUMINUM ALLOY PISTON



## PERMA-GROOVE\*

WITH SEGMENTAL STEEL TOP RING SECTION

Again, Zollner engineering leadership provides another great piston development to engine builders. The new Zollner "Perma-Groove" gives sensationally longer life to pistons and rings, prevents blow-by, minimizes oil consumption. The light weight segmental steel section incorporates high wear resistance in the top ring groove *plus* the advantage of cool operation. Designed especially for gasoline engine pistons, "Perma-Groove" is the quality, low-weight and low-cost companion to the popular "Bond-O-Loc" piston for Diesel engines. We suggest an immediate test of "Perma-Groove" advantages for your gasoline engine.

\*T. M. Reg. Pat. App. For



TOP RING SECTION



FRONT VIEW SECTION



CROSS SECTION

### OUTSTANDING ADVANTAGES OF ZOLLNER "PERMA-GROOVE" TOP RING SECTION

1. Individual steel segments eliminate continuous band expansion problem.
2. Segments securely locked to prevent radial movement.
3. Dovetailed edges keep steel segments securely in plane with groove.
4. 75% steel bearing area for wear resistance.
5. 25% aluminum bearing area for heat conductivity and cool operation.
6. Light in weight.

ADVANCED  
ENGINEERING  
PRECISION  
PRODUCTION  
COOPERATION  
WITH ENGINE  
BUILDERS

ZOLLNER

PISTONS

THE ORIGINAL EQUIPMENT PISTONS

# ZOLLNER

ZOLLNER CORPORATION • Fort Wayne, Indiana

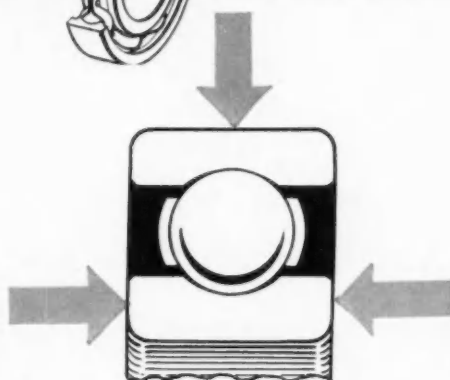
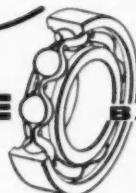


# FACTS

about

**NEW DEPARTURE**

**BALL BEARINGS**



**The Word**  
*Versatile*

## **Fits Like A Glove!**

**Fits because**—this basic New Departure ball bearing, more widely used than any other antifriction type, does much more than carry RADIAL loads—it locates the shaft it supports against THRUST LOADS FROM BOTH DIRECTIONS equally well!

**Fits because**—with a simple snap ring added, it does away with inside housing shoulders, simplifying mounting and cutting machining costs!

**Also**—with efficient Senti-Seal added, without change in exterior dimensions, it eliminates a separate outside closure—assures protection from outside dirt!

**And**—with Senti-Seals on both sides, this same basic bearing does away with all separate seals, eliminates all need for lubricating fittings—requires no attention for greasing!

**Finally**—it is a long-lived, non-separable unit that calls for no shims or other devices for periodical adjustments.

So, specify New Departures of the type that assures you maximum application proficiency and economy.

**BALL BEARINGS MAKE GOOD PRODUCTS BETTER**

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.